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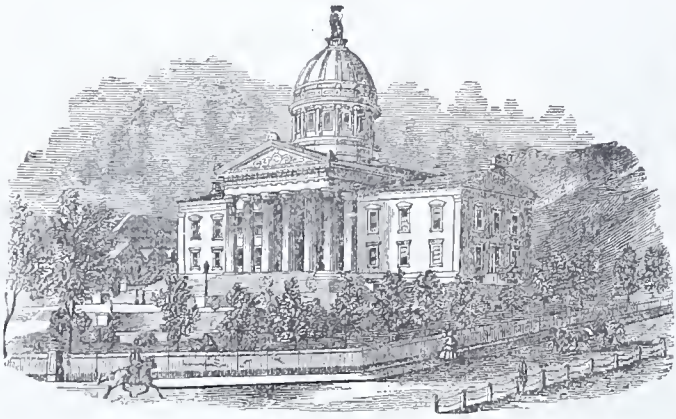

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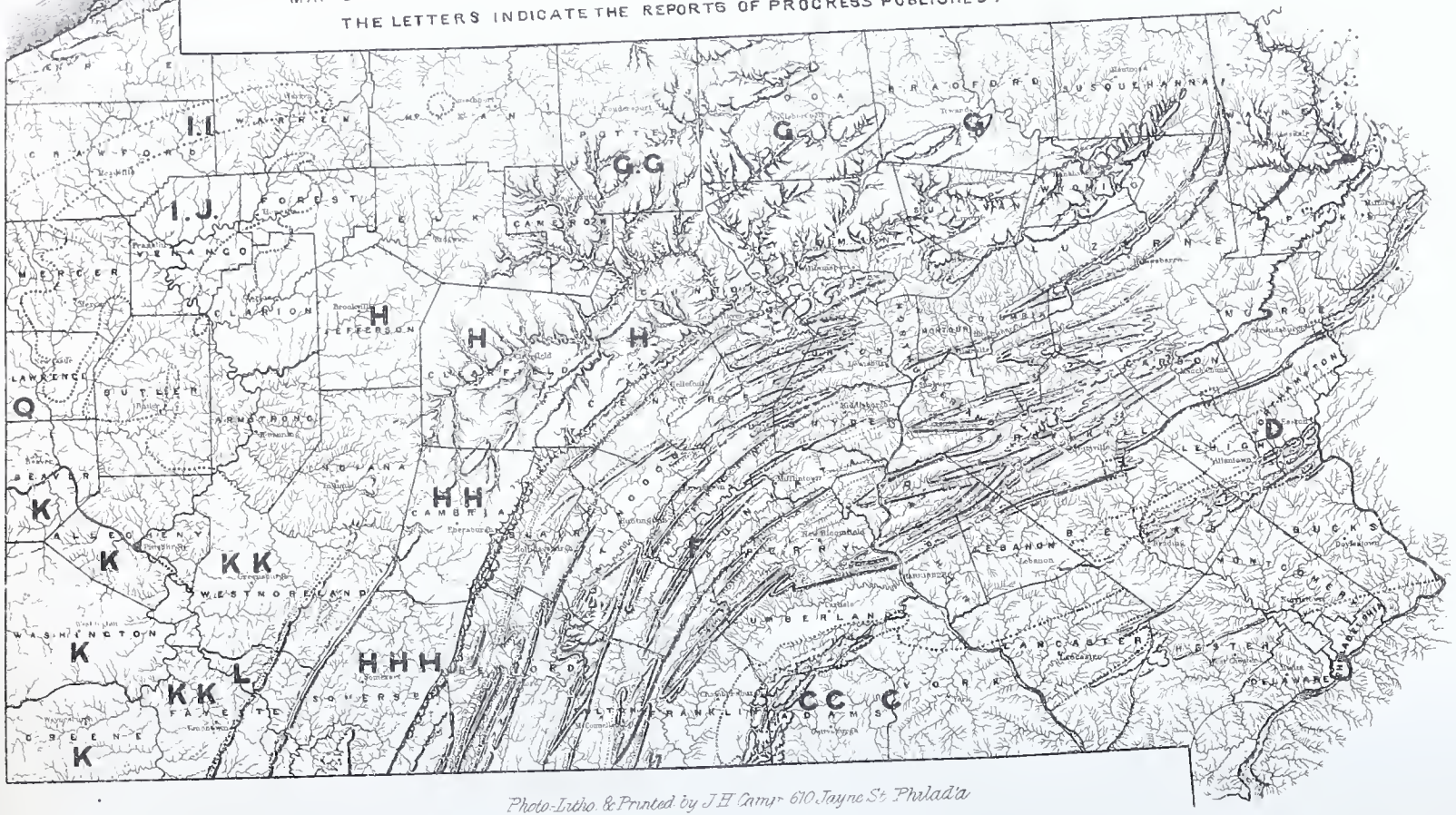
THE LETTERS INDICATE THE REPORTS OF PROGRESS PUBLISHED.



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SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA:

1876.

REPORT OF PROGRESS

IN THE

CAMBRIA AND SOMERSET DISTRICT

OF THE

BITUMINOUS COAL-FIELDS

OF

WESTERN PENNSYLVANIA.

BY

F. AND W. G. PLATT.

ILLUSTRATED

WITH 110 WOOD-CUTS AND 6 MAPS AND SECTIONS.

PART II. SOMERSET.

HARRISBURG:
PUBLISHED BY THE BOARD OF COMMISSIONERS
FOR THE SECOND GEOLOGICAL SURVEY.
1877.

Entered, for the Commonwealth of Pennsylvania, in the year 1877, according to acts of Congress,
By JOHN B. PEARSE,
Secretary of the Board of Commissioners of Geological Survey.
In the Office of the Librarian of Congress, at
WASHINGTON, D. C.

Printed by
B. F. MEYERS, *State Printer*,
HARRISBURG, PA.

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615 Walnut Street,
Philadelphia, *December* 31, 1876,

Prof. J. P. Lesley, *State Geologist:*

Dear Sir:—I have the honor to submit to you A Report of Progress upon that part of Somerset county lying west of the Allegheny Mountain.

Field work was resumed, in accordance with your instructions, in June, 1876, at the place where it had been suspended at the close of the season of 1875.

Mr. W. G. Platt, Geological Assistant in Cambria and Somerset counties, made the detailed examination, and this report has been prepared jointly by him and myself. A few of the sections used in the report were made by Mr. C. A Young, aid on the Survey, in the season of 1875.

Mr. R. H. Sanders, Topographical Assistant, spent the month of November in making a topographical map of the Salisbury Basin in Somerset county, and his work was characteristically rapid and excellent.

In all parts of the county the residents willingly furnished to the Survey information and assistance; and special kindness was received from Mr. E. K. Hyndman, General Superintendent of the Pittsburg and Connellsville railroad; Hon. E. D. Yutzy and Mr. N. Scott, of Ursina; Hon. E. D. Scull, President of the Pittsburg and Baltimore Coal, Coke and Iron Company; Mr. S. Philson and Mr. Wigle, of Berlin; Mr. De France, Superintendent of the Keystone Coal Company, Meyersdale; Mr. Batzer, C. E., of Meyersdale, and many others.

I remain, very respectfully,

FRANKLIN PLATT.

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PREFACE TO HHH.

The Report of the Progress of the Geological Survey of Pennsylvania in Somerset county now published, as prepared by Mr. Franklin Platt and Mr. Wm. G. Platt, to whom was intrusted the continuation of the work of the corps southward from Cambria county,* is so complete that the local geologist will have no difficulty in finding what he wants to see or examine more minutely for himself; he has only to consult the copious index at the end of the volume, from which, it is believed, has been omitted no name of person, place, formation, exposure or mine mentioned in the text.

This Index will also serve to a certain extent as a synopsis of and guide to the geology of the Coal Measures; as its items have been carefully classified and duplicated and arranged, wherever it was possible to do so, in a regular order of superposition from above downwards, and also in a regular geographical order from north to south, *within the limits* of each of the three sub-basins, commencing always with the first, or Salisbury, then the Somerset, and then the Johnstown-Confluence sub-basin. By noticing the page references the reader will soon be able to guess from them alone into which sub-basin his reference will fall.

The last chapters of the book† are intended to furnish the citizens of Somerset county who may not own reports on other counties in Western Pennsylvania with a summary of the principal facts relating to the Bituminous Coal Region, making a statement of not only what is now known of the First of its Great Basins from Lock Haven to Salisbury, but of its geological relationship with the basins lying west of it.

*See Report of Progress HH, Cambria county, 1876.

†Part IV, Chap. 17, page 285, and Chap. 18, page 315.

In those last chapters are explained the references made elsewhere in the book to an old and important error regarding the thickness of the Barren Measures, the number and character of the coal beds and limestones included in them, and especially the place in the series to be assigned (now for the first time with certainty) to the Elk Lick Coal and Limestone and to the Johnstown Iron Ore.

This error has begotten such embarrassment and confusion that I am unwilling to leave its origin and authorship in doubt, and will therefore give at the close of this preface a short history of it not uninstructive to those on whom fall the responsibilities of our profession.

Somerset is divided into two parts; a smaller part, composed of Allegheny, Northampton, Larimer, Greenville and Southampton townships, lying east of the crest of the Allegheny Mountain and outside of the Bituminous Coal Fields of Western Pennsylvania; and a larger part lying west of that crest and extending across the First Great Coal Basin to the Laurel Hill Mountain.

This Report is concerned only with the larger part, the south-eastern townships being left to another report, to be included in another volume devoted chiefly to the Geology of Bedford county.

The townships of Somerset county are arranged geographically in the following manner:

Conemaugh.			Paint.	
Jenner.		Quemahoning.	Shade.	
Jefferson.	Somerset.		Stone.	
Middle Creek.	Milford.	Brother's Valley.		Allegheny.
Upper Turkey Foot.				Northampton.
Lower Turkey Foot.		Summit.	Larimer.	South-ampton.
Addison.		Elk Lick.	Greenville.	

The north county line between Somerset and Cambria commencing on the crest of Laurel Hill, 6 miles south-west of Johnstown, runs due east 7 miles to Stony Creek; thence up the bed of Stony and Paint creeks 6 miles to Scalp Level;

thence due east 10 miles to the crest of the Allegheny Mountain, 6 miles south of the north-west corner of Bedford county.

The east county line between Somerset and Bedford keeps the crest of the Allegheny Mountain south-southwest 14 miles to a point 1½ miles north of the Bedford pike; thence due south 16 miles, across to the north knob of the Cumberland Coal Basin and along the crest of Savage Mountain to the gap of Will's creek, and Baltimore and Pittsburg railroad 2 miles west of Bridgeport; thence 7 miles along the crest of the same Savage Mountain to the Maryland State line.

The south county line between Somerset and Maryland runs due west 31 miles, across the Cumberland Coal basin, across the anticlinal valley west of it, across the Allegheny Mountain, Salisbury Coal basin, Negro Mountain and Winding Ridge to the bed of the Youghiogheny river.

The west county line between Somerset and Fayette runs down the bed of the river northward, past Confluence, to the centre of the gap through Laurel Hill, a distance, in an air line, of about 9¼ miles; thence north-north-east 15 miles along the crest of Laurel Hill to the north-east corner of Fayette; thence more north-east 21 miles still along the crest of Laurel Hill (with Westmoreland county on the west of it) to the place of beginning.

The greatest length of Somerset county is 39 miles; the greatest breadth 36 miles; the total area 682,240 acres, or 1,066 square miles.

The surface of Somerset county is everywhere broken by water courses (in valleys from 100 to 400 feet deep) draining northward and westward into the Conemaugh river and southward and westward into the Youghiogheny, while the principal mountain ranges are seen running north and south, or more accurately, north-northeast and south-southwest.

To represent this drainage system and the water basins of the county a map (Plate XVII*a*) has been made, on which the townships are marked by their initial capital letters, and all other names omitted, so that the eye can take in at a glance the scope and direction of the streams: Paint, Sandy and the Quemahoning in the north; Buffalo, Elk Lick, Flaugherty's run, Middle creek, White's creek, Laurel run, (or the North

Fork,) all branches of Castleman's river, itself the middle branch of the Youghiogheny river,—in the southern townships; and Will's creek in the south-east.

It will be observed that none of the drainage of Westmoreland and Fayette counties enters Somerset county. Laurel Hill is only broken to let out the combined waters of northern Somerset, past Johnstown and Blairsville, into the Allegheny river north of Pittsburg,—and again to let out the combined waters of middle and southern Somerset past Confluence and Connellsville, into the Monongahela river south of Pittsburg.

Even part of Greenville township, east of the crest of the Allegheny, drains westward through the barriers with all the rest into the Ohio river. Western Maryland is drained northward and westward through Somerset county into the Ohio River valley. In other words, there is an inclined water plane from the crest of the Allegheny Mountain (or, geologically speaking, from the great anticlinal uplift which occurs to the east of it) all the way to and beyond Pittsburg, and also an inclined water plane from Western Maryland and West Virginia into Pennsylvania.

This plane is represented (at water level) by the elevations of the stations on the Pennsylvania RR. in Cambria county, and by the elevations of the stations on the Baltimore, Cumberland, Connellsville and Pittsburg RR. in Somerset county, thus:

In Cambria County.

Freeport.....	Saltzburg....	Bolivar.....	Conemaugh..	Mineral Point.	Portage.....	Lilly's.....	Gallitzin.....	Summit.....
770′	891′	1,033′	1,225′	1,414′	1,675′	1,887′	2,161′	2,280′

In Somerset County.

Pittsburg.....	Jacob's Cr....	Connellsville.	Ohiopile.....	Confluence...	Shoofly T.....	Mineral Pt....	Sand Patch T.	Allegheny Mt.
751′	794′	894′	1,237′	1,346′	1,614′	1,825′	2,226′	2,286′

Further discussion of the phenomenon of Allegheny Mountain drainage will be found in the first chapter of the Special Report L (1876) on the Coke Region of the Youghiogheny river, and in the preface to Report of Progress HH (1876) on Cambria county, wherein a large amount of hypsometrical data is given, to which the following may here be added:

Railway and other Levels.

The Pittsburg division of the Baltimore and Ohio railroad crosses the Allegheny Mountain in Somerset county and follows down the right bank of Castleman river from Meyersdale to Brook Tunnel, at which point it cuts through the Hog Back ridge by a tunnel 1,600 feet in length, placing itself on the waters of Laurel Hill creek, which it then follows to the Turkey Foot; thence the railroad skirts the right bank of the Youghiogheny, and passes out of the county in the deep gap of Laurel Hill. This road, well equipped and in good condition, places the southern part of the county in direct line of communication with the Atlantic seaboard and the West.

The following table shows the elevation of each station along the line of the railroad in Somerset county above mean tide at Baltimore:

Southampton	East of Allegheny Mountain crest.	.....	1,564′
Glencoe		.....	1,633′
Philson's		.....	1,861′
Sandpatch Tunnel		.....	2,226′
Summit			2,286′
Meyersdale			2,063′
Garrett			1,948′
Pine Grove			1,874′
Mineral Point			1,825′
Castleman Station			1,757′
Pinkerton			1,649′
Shoo Fly Tunnel			1,614′
Brook Tunnel			1,558′
Ursina.			
Confluence			1,346′
Draketown run			1,319′

The Salisbury and Baltimore railroad runs for a few miles up the Castleman river from Meyersdale, furnishing an outlet to the Pittsburg coal area of that region.

The following is a list of levels along its line:

Baltimore and Ohio railroad junction	2,095′
Meyersdale	2,063′
Coal mines *	2,067′
Romain	2,073′
Keystone	2,075′
Livengood's mill	2,100′
Salisbury	2,131′
Coal mines †	2,331′

The Buffalo Valley railroad runs north-eastward from Garret to Berlin, the stations along the line occupying the following elevation above mean tide at Baltimore:

Garrett, as before	1,948′
Burkholder	1,992′
Büchle	2,010′
Bitner	2,044′
Pine Hill	2,064′
Hanger's	2,073′
Berlin ‡	2,176′

The Somerset and Mineral Point railroad, running along Coxe's creek connects the county seat with Mineral Point, a station on the Pittsburg division of the Baltimore and Ohio railroad.

Mineral Point, as before	1,825′
Sames	1,839′
Baker's	1,889′
Milford	1,932′
Mud Pike crossing	2,016′
Roberts	2,042′
Cantner	2,108′
Somerset §	2,128′

The northern half of the county is still without railroad facilities, although a junction might easily be effected with the main line of the Pennsylvania railroad traversing the southern portion of Cambria county. Active steps toward this end were at one time taken, when two available routes were surveyed, Johnstown being the northern terminus in both cases.

---

* Cumberland and Elk Lick Coal Company.

†Salisbury and Baltimore Coal Company.

‡ The railroad station at Berlin is by barometer 180 feet below the central square of the town.

§ The railroad station is here 80 (?) feet by barometer below the square.

The following table gives the elevation of a few points along the proposed Stony Creek line:

Junction with P. RR. at Johnstown	1,184′
Mouth of Ben's creek	1,215′
Mouth of Paint creek	1,305′
Mouth of Shade creek	1,485′
Hooversville	1,669′
Turnpike at Sprucetown	1,754′
Mouth of Beaver Dam creek	1,760′
Head of Beaver Dam creek	2,062′
Head of Wells creek, near Somerset	2,219′
Somerset, Patriot street	2,106′
Head of Stony Creek, at Berlin	2,292′

To the above list of accurate instrumental levels may be added the elevations of a few of the principal points in the county that were measured by means of a trustworthy aneroid. These measurements must, however, only be regarded as approximately correct:

Ashtola	2,207′
Shade Furnace	2,002′
Scalp Level	1,662′
Red Bridge	1,250′
Davidsville	1,723′
Forwardstown	1,580′
Stanton's Mills	1,690′
Morgan's Mills	1,750′
Jennerville	2,003′
Jenner Cross Roads	1,990′
Stoystown	2,094′
Buckstown	2,585′ (??)
Shantzville	2,220′
Somerset (square)	2,208′
Bakersville	2,120′
Gebhartsburg	2,108′
Berlin (square)	2,356′
Berkeley's Mills Bridge	2,048′
Hay's Mill*	2,158′
Salisbury	2,180′
Listonville	1,782′
Petersburg	2,037′
Jersey Church	1,587′
Ursina Bridge	1,357′

The following levels of the Cumberland Turnpike road are also interesting in this connection:

Cumberland	635′
Frostburg	1,890′

*This level was obtained at the old opening in the Middle Freeport Coal, on Blue Lick creek, one-half mile above the mill.

Great Savage Mountain Summit	2,657′
Savage river, 2 miles from head	2,376′
Little Savage Mountain summit	2,535′
Little Backbone Mountain summit, at Beall's, dividing eastern and western waters	2,372′
Meadow Mountain summit (Allegheny Mountain),	2,654′
Castleman river	2,077′
Negro Mountain summit	2,826′
Keyser's Ridge summit, a spur of Negro Mountain,	2,843′
Winding Ridge summit	2,534′
Smithfield, on Youghiogheny river	1,405′
Barren Hill summit [Laurel Hill?]	2,450′
Woodcock Hill or Briery Mountain	2,500′
Laurel Hill [Chestnut Ridge?]	2,412′
Monroe, at western base of Laurel Hill [Chestnut Ridge?]	1,065′
Uniontown	952′

It will be seen by reference to the drainage map of Somerset county above referred to, that the Maryland waters penetrate northwards almost to the centre of the county before they can find their way through the Negro Mountain uplift, declining northwards. They then return southwards to meet the Virginia waters, and all together break westward through the great uplifts of Laurel Hill and Chestnut Ridge, into the Monongahela river country.

The northern waters of Somerset county flow northward to meet the waters descending through Cambria county, and all together break in like manner through the uplifts of Laurel Hill and Chestnut Ridge into the Allegheny river country.

Between these two systems of northward and southward flowing waters lies a high flat rolling divide on which stand Berlin and Somerset, the county town. This water shed crosses the county from south-southeast to north-northwest, and is made up of the "Barren Measures," holding the important Berlin coal beds, described in chapters 1, 2, 3 of this volume.

Through this central divide and across it (north-northeast and south-southwest) run the subordinate uplifts or anticlinal axes of Negro Mountain and of the Viaduct; sub-dividing the First Bituminous Coal Basin in Somerset county into its three sub-basins of: 1. Salisbury and Berlin; 2. Somerset; and 3. Johnstown and Confluence.

These basins are described in this volume geologically in this order, beginning at the north end of each basin; and the bounding mountains and sub-dividing uplifts may be followed by the reader from point to point where observations of them could be made, by consulting the index.

The most important of these sub-basins, that of Salisbury, holding the Pittsburg coal area, is specially illustrated by two maps; one a topographical map of the ridge south of Meyersdale and west of Salisbury, carefully surveyed by Mr. Sanders, who ran the outcrop of the Pittsburg coal bed around every one of the areas left on the hill tops west of Castleman's river; and upon this map all the mines and old openings in the coal, with their railroad tracks and incline planes, may be seen. Mr. Sanders has even mapped every fence which separates two fields throughout this little region. The contour lines represent elevations above ocean level, 10 feet apart, the elevations being marked along the river bed and elsewhere. The re-enforcement of the contour lines on the southern and eastern hill slopes brings out the relief of the topography as in a model; and it is intended to make from this map an exact model of the ridge, colored geologically, for the Museum of the Survey.

To explain the isolated patches of the Pittsburg coal bed, and to show the shape of the basin (or dimple in the centre of the sub-basin) which has preserved these patches of the bed, I have drawn another contour line map to represent the *floor of the Pittsburg coal bed.* It is the first time, as I believe, that this has been attempted, and it is therefore an important feature of the report to which I call special attention.*

---

*In expressing this opinion, however, I wish to do justice to Mr. Benjamin Smith Lyman, the director of the Geological Survey of Japan, whose geological maps of mining properties in this country and of the coal fields of Yesso and Niphon differ from those of all other geologists in this respect, that they combine two sets of contour lines, tho one representing the hypsometry of the surface of the country in the ordinary way, and the other representing the hypsometry of the mineral bed or beds which are of most importance underground. His recent maps, executed by the native assistants whom he has himself trained in the field, are models of clearness and fulness, worthy of all praise.

The peculiarity of my map of the Pittsburg bed in the Salisbury ridge consists in its simple exhibition of the shape of the bed where it has been pre-

The innermost curve represents all the points in the floor of the coal bed 2,140 feet above ocean level. The space inclosed by this curve is supposed to be everywhere between 2,130′ and 2,140′; although in the absence of mining operations it is impossible to tell whether there be not slight hills and hollows in it, although they probably amount to not more than a few feet. The coal rises from this level of 2,140′ westward to a level of 2,370′, a rise of 230 feet in about a mile. While at the north end of the basin opposite Meyersdale the coal is only 2,150 feet, it is at the south end near the Maryland line 2,440 feet above sea level, a difference of 290 feet. It is no wonder then that the inhabitants of Somerset county cherish an almost unconquerable belief that the Pittsburg bed passes over the Castleman's River valley into the hill country to the north, and is the six foot coal bed at Berlin. Ordinary arguments good for a geological mind fail to overcome this false impression, but I feel great confidence that the true state of the case will be made plain to even the least disciplined minds when they look at the shape of the curves at the north end of this map and see how they show the basin rising rapidly over Meyersdale northward towards Berlin, shooting the Pittsburg Coal high into the air in that direction. The rest of the demonstration must be left to the excellent descriptions which Mr. Platt has given of the Berlin coal series in Chapter 5.

Another striking feature of the map is indicated by levels above ocean marked along the bed of Castleman river thus: The 2,400 foot curve in the coal is seen passing over the 2,050 foot level in the river, showing that the Pittsburg coal bed formerly existed in the air 350 feet above the present river bed, one and a half miles south of Salisbury. Similar calculations can be made at all other points; and nothing could so well exhibit the vast extent of erosion and waste of this valuable coal

served, and also of its probable ancient shape in the intermediate areas from which it has been long since removed by erosion. It gives us, therefore for the first time, an opportunity to reason justly upon the irregular or unsymmetrical shape of our coal basins, and suggests most important facts for the consideration of mining engineers in the bituminous coal region of Pennsylvania. Among other things it shows very plainly how flat the centre of a coal basin can be, while its walls are steep, a phenomenon exactly the reverse of that which is exhibited along the centre lines of some of the crushed anthracite synclinals.

bed, which once extended in an unbroken sheet from Salisbury to Mount Savage, and no doubt much farther towards Baltimore. There is as little reason to doubt that it originally covered the whole of Somerset county and the whole of the Ligonier valley in which a few fragments of it still exist, and was joined to the sheet which spreads through Blairsville, Latrobe and Connellsville towards the south and west.

The striking resemblance of the Pittsburg bed in the Salisbury basin with the great bed in the Cumberland basin in Maryland, its future importance for the Potomac river coal trade as a steam coal for ocean commerce and its already extensive development, made imperative an estimate of the individual and collective areas of the coal bed on the Salisbury ridge available for future supply. It is a rule of the Survey that such estimates shall be publicly reported whenever they can be based upon unquestionable data obtained by running the outcrops. Such data have been obtained in this instance; and the calculated areas based upon Mr. Sander's survey, and given on pages 96 to 100 of this volume, will undoubtedly be found very nearly, if not quite, correct by the coal companies interested in the region. Allowing for slight variations in thickness of the bed, we have a total of Pittsburg bed coal of about thirty-five million (35,000,000) tons.

Several private surveys of these isolated areas have been made during the last fifteen or twenty years. By none of these surveys were the outcrops instrumentally surveyed, the openings being referred, as far as possible, to their positions on mining property maps and connected together around the hill sides by topographical sketching. With regard to the larger areas in the north and middle districts of the ridge this method was amply sufficient for the purpose, the openings on the bed being good and numerous, so that there was no possibility of greatly mistaking the limiting outcrop. This was not the case however with the smaller areas near the Maryland line, where the openings were few, the hill-slopes gentle and the hill-tops flat. Here a great and pardonable error was committed. The true Pittsburg bed near the top of the hills having a bold limestone over it, and lying at a great elevation above the coal openings further north, was very naturally mis-

taken for the Sewickley coal bed below the Great Limestone, which in like manner caps the northern hill-tops. It was therefore supposed, and in the absence of sufficient openings there was good reason to suppose, that the Pittsburg bed existed more than a hundred feet lower down in the hills; that it extended into other neighboring hills overhanging the river, which are now known not to contain it; and, therefore, that its area was two or even three times as great as it is now known to be. This error, embarrassing as it is, is one inevitably connected with early reconnoissance surveys in all coal regions, and must be set to the account of the impatience of land owners in a time of mining speculation, and to the insufficient means placed at the disposal of professional geologists by those who demand difficult work at a small price.

A *scheme of the formations* underlying all that part of Somerset county geologically reported upon in this volume has been already given in Reports H and HH, on Clearfield and Cambria county, and is here repeated for the benefit of those who do not possess the above-mentioned reports. It is intended to represent not only all the formations which would probably be passed through by a well or borehole, drilled or sunk straight down from the highest hill top in the Salisbury basin south of Meyersdale, to a depth of ten miles; but also the formations which are known to have been swept or worn away from the Salisbury ridge when that ridge was nearly two thousand feet higher than it is to-day, and contained the coal beds, limestones, shales and sandstones which still remain in place over a large part of Greene and Washington counties.

This scheme is given on the opposite page.

It will be seen, however, on reference to the Clearfield and Cambria reports that while the order of formations remains of course the same, some modification of its nomenclature has been made, and for the following reasons:

Recent correspondence with Prof. Fontaine, of the West Virginia University at Morgantown, has convinced me that the third sub-heading of the scheme, "*Kanawha River System*," will lead to future embarrassment, because the Kanawha river does not receive that name until it has passed to the west of the great outcrops of that system, retaining its name of New river

Scheme of the Formations.

Numbers used by H. D. Rogers.

I. The Carboniferous System.
1. *Monongahela River Coal Series.*
Upper Barren Measures.
a. Greene County Group.
b. Washington County Group.
Upper Productive Coal Measures.
2. *Allegheny River Coal Series.*
Lower Barren Measures.
Lower Productive Coal Measures.
a. Freeport Coal Group.
b. Kittanning Coal Group.
c. Clarion Coal Group.
Pottsville Conglomerate (Seral)..... XII
d. Sharon and Quinnimont Coal Group.
Mauch Chunk Red Shale, Mountain Limestone, *e.* New River Coal Group, ... XI
Pocono Sandstone (Vespertine) (Mountain Sands)..... X

II. The Devonian System.
1. Catskill Sandstone (Old Red) (? Oil Sand Group)..... IX
2. Chemung sands and shales,
3. Portage shales and sands,
4. Hamilton formation, Genesee black shales, Hamilton sandstones, Juniata River Coal Group, Marcellus black shales, ... VIII
5. Upper Helderburg Limestones,
6. Oriskany Sandstone..... VII

III. The Silurian System.
1. Lower Helderberg Limestone..... VI
(Salina, Niagara, &c.)
2. Clinton red shales and fossil ore..... V
3. Medina Sandstone, 4. Oneida Conglomerate, ... IV

IV. The Siluro-Cambrian System.
1. Hudson River slates, 2. Utica slates, ... III
3. Trenton Limestone, 4. Magnesian Limestone, (Chazy, Calciferous, &c.,) II
5. Potsdam Sandstone I

V. The Cambrian System. (South Mountain.)
VI. The Huronian System. (Philadelphia rocks.)
VII. The Laurentian System. (Highlands.)

as low down as the mouth of the Gauley river, where the "*Kanawha River System*" has mainly or entirely gone beneath water level. And yet the term New River System cannot be employed, because it is required for the coal measures of Montgomery and Wythe counties in Virginia, the fourth and next lower system in the scheme. I have therefore substituted the name Quinnemont beds, with which I understand Prof. Fontaine to acquiesce, at least for the present and until a better name can be suggested.

Great difficulties have encountered all geologists attempting to harmonize the English names Devonian, Silurian, Cambrian, with deposits of those ages in America.

The top of the Devonian System is not settled in England any more than in America, and much discussion on the subject is expected at the next August meeting of the British Association to be held in Portsmouth on Devonian ground. In recent conferences with the distinguished palæontologist of the New York survey, Prof. James Hall, I was led to believe that he entertains pretty decided convictions that the fossils of the Pocono Sandstone are those of the Waverly sandstone of the Ohio geology, and cannot be considered Chemung fossils. On quite independent grounds Mr. John F. Carll, in charge of the survey of the Oil Regions, will soon publish in his second Report of Progress (I.I.I.) his opinion that there is a complete break between the upper or Mountain Sand group of Oil creek, from which Prof. Hall gets these Pocono fossils, and the lower or Oil Sand group which overlies the true Chemung. This Oil Sand group, about three hundred feet thick, may possibly be the thin western representative of the Red Catskill Formation, which is several thousand feet thick in Eastern Pennsylvania and Eastern New York, and is by general consent considered the American representative of the upper Old Red member of the Devonian system.

The bottom members of the Devonian it is impossible to determine with certainty; but as recent American geological works have carried the Devonian column down to the base of the Oriskany under the influence of a theory that every great geological age must be marked by some evidence of movement, change of shore line and deposit of gravel beds, it seems reason-

able to commence the Devonian age with the coarse Oriskany, as we commence the Carboniferous age with the coarse Pocono.

The contention of English geologists over the names Silurian and Cambrian cannot be composed in this country. Some will continue to side with Murchison and speak of Lower Silurian; others will continue to side with Sedgwick and prefer to say Upper Cambrian; a third party, headed by Dr. T. Sterry Hunt, will compromise on Siluro-Cambrian. But apart from this logomachy it remains to be decided whether the Oneida Conglomerate shall assume its theoretical place at the beginning of an era. There are strong reasons against it, but they are not quite strong enough to forbid it. For the sake of the symmetry of the scheme, therefore, I include the Oneida in the Silurian (or Upper Silurian.)

The base of the Siluro-Cambrian is for the same reason lowered to include the Potsdam sandstone.

The Cambrian system in America is not yet sufficiently known. The present state of our knowledge, with all its mystifications and embarrassments, will be painted by Dr. Hunt in his Report of Progress E, now going through the press.

Those who wish to study the Devonian and Silurian formations will find them outcropping in Somerset county east of Sand Patch tunnel, and in Bedford county along the line of the railroad from Bridgeport to Bedford; or better still, along the Potomac river from Cumberland to Hagerstown.

A detailed scheme of the Somerset county rocks proper, from the Uniontown coal bed to the Mountain limestone, is given on pages 286, 287. For the local filling up of the interval rocks in this scheme the reader is referred to the many vertical sections scattered through the pages of this volume.

Some allusion should be here made to the important and often difficult determination of the bottom line or synclinal axis of each sub-basin of Somerset county, and to the equally important and sometimes equally difficult determination of the highest part or axial line of the two anticlinals which traverse the county and separate the three sub-basins. The reader is referred to the index for references to all the paragraphs in the volume where such determinations are stated, and under the

word "dip" in the index he will find other useful references to the same subject.

The two antielinals which sub-divide the first great coal basin in its run through Centre, Clearfield, Cambria and Somerset counties, are earefully loeated and traced in reports H and HH, as well as in this volume, and a good understanding of the nature of these rolls in the bed of the basin requires a reference to those reports, wherein the breaks and geological shiftings to the east or west of these anticlinals are noted and deseribed. Each of these two lines of gentle uplift consists in fact of a series of short uplifts, in a broken linc, with offsets to the right and left, the ends of the short lines composing the series somewhat overlapping each other, now to the right, now to the left. Such irregularities are exeessively embarrassing to mining engineers and often very disappointing to land owners, but when they are once and for all discovered and explained by a thorough and systematie geologieal survey they lose their power to disturb our calculations; but they may produce the physical effect of deepening the basin where it was supposed to be shallow and shallowing it where it was supposed to be deep. They always also govern and give eharacter to the topography or surface shape of the country. They determine the direction of the drainage and the shape and extent of the water basins.

No coal basin has a perfectly symmetrical shape; nor is it bounded by perfectly symmetrical anticlinals; nor are the rolls in its bottom symmetrical, although their general symmetry is something admirable. Loeal diversity with general uniformity is the most characteristie feature of the First Bituminous Coal Basin of Pennsylvania.

This is no exeeptional phenomenon. It is noticeable in most of our coal basins. It repeats itself again and again in the anthraeite basins; in Ligonier Valley, and in the shallow troughs of the northern counties; and Professor Stevenson exhibits its effeets upon the geology and topography of all that region of South-western Pennsylvania lying between the Chestnut Ridge and the Ohio State line, where even the major axes of uplift show a longitudinally broken or *échelon* eharacter.

The strain of side pressure from the east against the country lying west of the Allegheny Mountain failed to break or seriously warp the folds of the more massive underlying conglomerates and sandstones; but in lifting and pressing these into a series of troughs it has squeezed together the overlying softer coal measures and caused them to bulge upward along each synclinal axis, producing a sub-anticlinal just where otherwise would have been the deepest part or line of the synclinal. Had the general side strain been perfectly even and symmetrical in its origin, in its direction and in its application, then this interior upward bulge or sub-anticlinal would have run as a continuous or unbroken vault along the centre line of the basin. But as the strain was from a great distance in middle or south-eastern Pennsylvania—as it acted radially against a great curve now represented by the Allegheny Mountain—as this curve is not a regular segment of a circle—as the strain was itself generated at various centres of origin, encountered various grades of resistance due to variations in the thickness of the rock formations to be pressed together, and was relieved by faults and slides in various places—it could not but happen that the First Bituminous Coal Basin should be folded with slight variations of dip in its sides and of depth in its bottom. These variations have determined both the degree and the position of the anticlinal fold along its central axis or synclinal line; occasionally breaking its continuity, and locating it sometimes a little to one side and sometimes a little to the other side of the theoretical axis of the synclinal.

The influence of the geology upon the agriculture of Somerset county can be stated in a very few words. The almost undisturbed flatness of the coal measures produce both smooth and high plateaus, gently rolling glades, and steep, rocky, sterile and wooded hillsides several hundred feet in height.

The massive limestones of the Upper Coal Series occur only along Salisbury ridge, but they make a fertile soil on the spot, and furnish abundance of lime for exportation.

Most of the county is a rolling country of Barren Measures, with hillsides of gentle slope, covered with a deep, though rather lean soil, easily improved by fertilizers.

The abundance of sandstone (Morgantown, &c.) above the Elk Lick coal bed makes the steep hill slopes of the Salisbury ridge.

The abundance of shales and numerous thin limestones between the Elk Lick coal and the Mahoning sandstone produced soft hill slopes and wide, low valleys, with a deep soil, very productive where the limestone beds are thick; and these beds furnish an abundance of lime for fields elsewhere. The "Somerset Glades" have always been famous as rich patures lands.

In the absence of limestone outcrops the Barren Measures furnish a lean, poor soil, and the use of fertilizers is strongly marked.

The Mahoning, Freeport and other sandstones of the Lower Coal Measures, with the Great Conglomerate, or Piedmont and Pottsville sandstones, cover belts of the country with angular stones, on steep hill sides with cliffs, overhanging ravines filled with laurel and heavily wooded. The whole slope of the Allegheny Mountain and of Laurel Hill and both slopes of Negro Mountain are thus characterized. The peculiarly wild and romantic scenery of the long defile of Castleman's river is thus produced.

One of the most important fruits of the re-survey of Somerset county reported in this volume has been the correction of a great error in the thickness of the Barren Measures made by myself when aiding Mr. James T. Hodge in his survey of the First Basin in 1840. I am wholly responsible for this error, because when I joined Mr. Hodge's camp at the Portage summit, in Blair county, in August of that year, it was agreed between us that he should devote his attention chiefly to the iron ore beds of Formation No. XI and of the coal measures, and that I should confine my efforts to building up a column of the coal beds and interval rocks.

Previous to being ordered by Prof. Rogers to join Mr. Hodge's camping party I had been working with Mr. Whelpley in the Anthracite coal fields, and knew nothing by actual observation of the Bituminous measures of Western Pennsylvania. I had to base my knowledge of the Western coal measures on the reports already made of the Allegheny River country, where the

key beds were the Ferriferous Limestone, the Upper Freeport Coal Bed, and the Mahoning Sandstone just above it at the top of the Lower Productive coal series. Above the Mahoning Sandstone a thickness of 600 to 700 feet of Barren Measures were reported, at the top of which lay the Pittsburg Coal Bed.

But from the entire area of Cambria county, and from a large part of the surface of Somerset county the Pittsburg bed had been eroded and only a portion of the Barren Measures were left standing.

Around Johnstown I had no chance to become acquainted with the thickness of the Barren Measures for want of the upper part. Around Salisbury I was equally at a loss for want of openings and exposures in the Lower Coal Measures. The country between Johnstown and Salisbury had scarcely been dug into; and as no workable coal bed was supposed to exist in any part of the Barren Measures, I was compelled to assume that *the largest coal bed at the top of any section must necessarily be the Upper Freeport Coal Bed.*

I felt the less hesitation in adopting this theory because at that time we knew of no great sandrock of the Barren Measures besides the Mahoning Sandstone at their base.

After working slowly and painfully southwards through August and September we came to make our camp at the falls of Elk Lick creek, in Summit township. And here I began for the first time seriously to suspect some great error in my column of the measures; for it then had to receive its coping of the Pittsburg coal and Upper Coal Measures in the Salisbury ridge; and here at the falls was a fine four foot coal bed at a depth of less than 300 feet beneath the Pittsburg.

And yet above this Elk Lick coal bed lay a massive sandrock, which we felt compelled to accept as the Mahoning Sandstone.

When the camp was next moved to the vicinity of Berlin I found again a fine coal bed under a massive sandrock, and calculated from the general dip that its depth below the Pittsburg bed must be about 300 feet.

Considering this to be the Elk Lick coal and also the Upper Freeport coal, with its covering of Mahoning Sandstone, and having no opportunity to measure down from the Pittsburg

in any other district of the First Basin, I could only harmonize our results with the reports (of 1839) from the north-western counties, by assuming an abnormal thinning down of the Barren Measures from 600′ in Westmoreland and Fayette to 300′ in Somerset county.

I felt, indeed, a constantly increasing doubt of the identity of the Elk Lick and the Berlin coal beds with the Upper Freeport of the Allegheny River country. A thousand discrepancies made the whole season's work unsatisfactory, and led me to predict that the progress of the survey would develop some law of non-conformability and irregularity over the Bituminous coal field, and might perhaps shake our confidence in the possibility of identifying any two coal beds in localities 50 or 100 miles apart. And so deeply did I feel this doubt that in handing in my report I could not bring myself to assign to the bed at Elk Lick falls the name of Upper Freeport Coal Bed. I therefore gave to it a provisional name, the "Elk Lick Coal Bed," and assigned to it a higher position in the series, without attempting the determination of its true position.

In my survey work of 1841 and 1842, in the northern counties from Tioga to Indiana, and in my private professional surveys, in subsequent years, in districts from the surface of which the Pittsburg Coal has been swept away, I was continually embarrassed with this Elk Lick bed, placed thus indedeterminately higher up in the column than the Upper Freeport coal bed; afraid to place it in the Barren Measures, on account of the supposed Mahoning sandstone over it, and yet unable to assign it a fixed position between the Mahoning sand stone and the Upper Freeport coal.

This embarrassment has been formulated in my "Manual of Coal," 1856, page 92, with no other end than that of causing as much embarrassment to other geologists as to myself. In fact no better evidence could be afforded of the unsatisfactory shape in which my work of 1840 left the geology of the coal measures of the First and Second Bituminous Coal Basins than the confused statements which are noticeable in that part of my Manual.

When Prof. H. D. Rogers came to publish his Final Report of 1858 he had evidently nothing to guide him to a better

comprehension of the measures in Cambria, Somerset and the Ligonier Valley; as such sentences as the following, on page 578, of Vol. II, Geology of Pennsylvania, will show:

"The Elk Lick coal bed here [at Brady's Bend, on the Allegheny river,] makes its appearance on the highest ground back from the river as the largest bed in the section [Fig. 427]; it is 50 feet above the Upper Freeport coal, and is fully 5 feet thick. We shall hereafter notice it again at Allegheny Furnace."

In fact, much of this part of his book was written from my reports of surveys of the Fourth and Fifth Coal Basins in 1841, in which I habitually called *any large bed found above the Upper Freeport Coal* by the indefinite name of the Elk Lick coal. Mr. Rogers is, therefore, no more responsible for the mistakes involved in the misuse of this name than was Mr. Hodge in 1840, although Mr. Hodge and myself were in daily consultation over the construction of the column.

But the errors of 1840 had a wider and more important range, for they inspired Mr. Rogers with ideas about an "enormous expansion" of the Barren Measures around Blairsville, "compared with their condition in and eastward of the second axis, or Chestnut Ridge," and to assert that this expansion has taken place *in the lower measures of the Barren Measures.* (Vol. II, page 601.) On page 500 he states the case thus:

(1) "No phenomenon in the geology of this region is more remarkable than the extraordinary discrepancy between the interval occupied by the Barren Measures and that which they fill in the First and Second. In the Salisbury division of the First Basin the vertical distance from the Upper Freeport coal through the Barren Measures to the Pittsburg coal is only 225 feet; in the Ligonier Valley, or Second Basin, (north end,) scarcely 200 feet; not ten miles to the west of this locality, where the latter measurements were made, and simply on the other side of the anticlinal axis of Chestnut Ridge, these strata swell to 600 feet in thickness, and that without any apparent increase in the number of economical beds of coal and limestone. The same Elk Lick creek, Barren Coal and Little Pittsburg Coal seems to reappear in the proper relative positions, but with a vastly enlarged thickness of interstratified

rocks, and these almost wholly composed of immense deposits of argillaceous shales. Possibly the great difference in the thickness of the group may arise from there having been an artifical barrier already elevated in the sea bottom at the time of the deposition of the materials the rate of this to vary on the two sides."

(2) "By a similar comparison of localities on the two sides of this same axis, far to the north, at Karthaus and at Bennett's Branch, we notice a similar increase of thickness, not in this Middle Barren Group, but in the Lower Group, the rocks between the Upper Freeport and Ferriferous coals."

(3) "Midway in the interval of Barren Measures above described, and seemingly persistent throughout the region, is a small coal bed, averaging 1½ feet in thickness. It is of value as an index to the other constituents of the group. Above it rests, in many places, a massive bed of sandstone, supposed to be characteristic of this portion of the series; and in connection with this coal are the "green limestone layers" traced extensively on both sides of the Conemaugh [in Westmoreland and Indiana counties] and far to the north. At Saltzburg these are 340 feet below the Pittsburg coal seam."

(4) "The Elk Lick coal, 80 feet below the former, in the section made [in Somerset county] along the Virginia line, is at that place [Elk Lick Falls] 4 feet thick. It doubtless will be found to occur in a similar position in the series everywhere, the interval increasing, perhaps, towards the north; but it must vary greatly in size, as it has been identified at only four localities, by its usual superior thickness to that of the other coals of the Barren Measures, &c."

All the views expressed by Mr. Rogers in the above quotations are now seen to be erroneous, and must be erased from the minds of geologists as vain speculations based on my imperfect, because inexperienced, observations in the survey of Somerset county in 1840.

My private surveys in subsequent years along Castleman's river led me, indeed, to the discovery of the great sandrocks and conglomerates of the Barren Measures high above the Mahoning Sandstone at Pinkerton's Point and elsewhere, and consequently to the enlargement of my measurements of the thickness of the

Somerset County Barren Measures. But none of the results of these surveys had been made public before the appearance of the Final Report of Prof. Rogers; and I may here add that none of them touched another vital point of the discussion of the coal measure column, viz: the question of the identity of the rock in the bed of the river at the end of Negro Mountain with the Seral Conglomerate, No. XII.

In Mr. Platt's report, now before the reader, he has redressed the whole section and removed its difficulties.

1. Mr. Platt proves that the Barren Measures are as thick in Somerset as they are in Fayette and Westmoreland counties; and, in consequence of this, that there is no *such* ground for the supposition that the anticlinal axis of Chestnut ridge was already elevated at the beginning of the Barren Measure age; a supposition, moreover, made doubly incredible by the fact that whatever is asserted of the anticlinal of Chestnut Ridge must be asserted of the anticlinal of Laurel Hill, which is like it in all respects.

2. Mr. Platt's Report (H) on Clearfield and Jefferson shows no such increase in the thickness of the Lower Productive Coal Measures at Karthaus and on Bennett's Branch as is stated by Mr. Rogers in the Final Report of 1858 to exist, that statement being based on Mr. Hodge's imperfect observations of 1840.

3. Mr. Platt proves that the massive sandstone at Saltzburg, "340′ below the Pittsburg coal," is Prof. Stevenson's Morgantown Sandstone, to be seen everywhere in Somerset county where the hills are high enough to take it in. This sandstone overlying the Elk Lick coal was originally confounded with the Mahoning Sandstone at the base of the Barren Measures, now shown to lie 300 feet beneath it; the interval including several coal beds and limestones, some of them identifiable with those in Prof. Stevenson's sections on the Ohio river. (Report K, page 76 and plate.)

4. Mr. Platt fixes finally the true place of the Elk Lick coal bed under the Morgantown Sandstone, and over the "Crinoidal Limestone;" and shows that the *upper* coal bed in the vicinity of Berlin is this same Elk Lick coal. It still remains to be

seen whether the Barton coal bed of the Cumberland Basin represents the upper or lower Berlin bed; but in Maryland it is certain that in any case we have at this high horizon of the Barren Measures a coal bed which is one of the most persistent and recognizable beds of the series, both in Virginia and in Pennsylvania, and as far west as the Ohio river; and the survey of Indiana county by Mr. W. G. Platt has already advanced far enough to show that it exists in the country north of the Kiskiminitas.

The reader is now called upon to *expunge from the Final Report of* 1858 *and from my "Manual of Coal" the name "Elk Lick Coal" wherever it occurs in its numerous false positions at the bottom of the Barren Measures and at the top of the Lower Productive Coal Series.*

J. P. LESLEY.

1008 CLINTON STREET, *July 26, 1877*

PART I.

FIRST SUB-DIVISION

OF THE

FIRST BITUMINOUS COAL BASIN.

IN

SOMERSET COUNTY.

CHAPTER I.

General Description of the Berlin-Salisbury Sub-Basin of Somerset County, including Description of the Allegheny and Negro Mountains.

It was shown in the Report of Progress for 1875* that the Wilmore sub-basin of Cambria county is a prolongation south-westward of the Osceola sub-basin of Clearfield county.

This same basin, included between the Allegheny Mountain on the east, and the Viaduct anticlinal sub-axis on the west, continues its course south-westward through Cambria county, but is observed to suffer a sub-division shortly before crossing the Somerset county border.

This is effected by the Negro Mountain anticlinal, which in the wilderness of Richland Township in Cambria county slowly detaches itself from the western flank of the Allegheny Mountain, and striking off south-westward at a sharp angle forms throughout Somerset county a bold, high and independent ridge.

The steady divergence of the two mountains necessarily causes the basin included between them to expand and broaden in a south-westerly direction, and at the Castleman river it is eight miles wide. From thence to the Maryland State line

*Report HH—Cambria county.

the course of Negro Mountain is nearly parallel to that of the Allegheny Mountain, and the basin therefore in this distance maintains an average width of about eight miles from mountain crest to mountain crest.

This is the *Berlin-Salisbury* sub-basin of Somerset county.

At its northern extremity the basin tapers off gradually to a point, and having been elevated high into the air by the uplift of this section of country, its included coal measures were thus exposed to the sharp denudation that planed these same soft rocks from the mountain tops, and the north-east portion of the basin is therefore almost destitute of workable coal beds.

Depth of the Basin.

But the basin is slightly tilted along its central line, and the effect of this steady subsidence is manifestly to gradually deepen the trough south-westward in the direction of the tilt; and though the sinking is not especially marked at any particular point, yet the effect produced becomes more and more obvious in proceeding south-westward through the various townships.

In the very brief description of these townships that will here be attempted, it is presumed that the reader is familiar with the scheme of the Coal Measures, already fully described in the Reports of Progress for 1874* and 1875,† and which will be found repeated in the Preface of this volume.

Just south of the Cambria county line the two mountain ridges, their crests capped with the Seral Conglomerate, are separated by a narrow plateau scarcely inferior in height to the enclosing mountains, and the eastern portion of Paint township is an almost unbroken wilderness of barren mountainous upland, of which the Seral (or Pottsville) Conglomerate covers by far the greater portion.

But in Shade township, directly south, the lowermost coals of the Lower Productive group sweep over nearly the whole basin, and the Seral Conglomerate is uncovered only in the beds of the deepest streams, and on the summit of the Allegheny Mountain. Detached hilltops here and there in Shade township include even the Freeport coal group.

Continuing south-westward, and crossing over into Stony

*Report H—Clearfield and Jefferson district. † Report HH—Cambria.

Creek township, the further increased depth of the basin is at once recognized. Thus, at Shanksville, only the highest coals (D′ and E) of the Lower Productive series, are above water level, and these coals are finally lost to sight beneath the wide sheet of Lower Barren Measures which comes in along the centre of the Basin in the southern portion of Stony Creek, and overspreads nearly all of Brothersvalley township.

At Berlin, about midway between Shanksville and the Castleman river, the Mahoning Sandstone, lying immediately on top of the Lower Productive Coal Measures, is certainly 300 feet, and perhaps as much as 350 feet below the surface. This permits nearly the entire group of Lower Barren Measures to come into the basin along its central line. The peculiar features of the Barren Measures in this sub-basin are fully discussed in a subsequent chapter.

At the Castleman river, in the vicinity of Meyersdale, in Summit township, the basin is observed to become even deeper, and all the Lower Barren Measure rocks, forming a group full 550 feet thick, have by this time sunk to a sufficient depth to permit the Great Pittsburg coal seam, capped by nearly two hundred feet of rock, to appear in the hills. From Meyersdale to the Maryland line this famous coal bed ranges along the centre of the basin, confining itself to a narrow area, which grows steadily narrower as it runs south-west. The Castleman river is not only the eastern but the extreme northern limit of the bed, and though the bluffs to the north of the stream at Meyersdale are of equal height (or nearly so) with those to the south, it nevertheless overshoots by a few feet the former line of hills. This is due to two causes. First, to the marked rise of the basin north-eastward, and second, to the interposition of a subordinate anticlinal roll in the rocks. This anticlinal roll, striking parallel to Negro Mountain, may be seen directly west of the Meyersdale railroad station, and occurs close to the synclinal of the basin. Its influence is perhaps felt only here at Meyersdale, and although slight, is yet of considerable importance.

At a point about five miles south-west from Meyersdale the basin begins to *rise slowly to the south-west*, until at the Mary-

land border the Pittsburg coal is left without cover, and the bed does not here cross the Mason and Dixon line.

The details connected with this most important part of the Berlin-Salisbury sub-basin, its resources and its present state of development, will be found elsewhere in this report.

The Allegheny Mountain in Somerset County.

The geological boundary limits of this Berlin-Salisbury sub-basin in Somerset county are complete, distinct and unmistakable.

The course of the Allegheny Mountain from Cambria county to the Maryland border undergoes no material change; in all this distance the mountain is everywhere a thickly wooded and uncultivated ridge.

Capped by a wide flat, covered deep with sand from the trituration of the Great Conglomerate, and with huge massive fragments of the same formation scattered abundantly over the surface, its crest is uniform, even, and maintains very nearly the same elevation from one end of the county to the other.

This is no mere accidental occurrence. The denuding forces of nature act under fixed laws, and the shaping of this vast mountain has been accomplished in strict conformity to them, producing the even crest protected by a thick mass of heavy sandstone; the steep and rugged eastern slope, and the long, gently sloping western flank which carries the Lower Productive Coal Measures downwards into the basin.

Nowhere in Somerset county has the mountain been cut completely through, and it is therefore a continuous and unbroken divide between the waters of the Susquehanna and Ohio throughout this much of its run. But deep ravines, some of which reach nearly to the mountain top, have been gouged out of its sides by descending torrents.

Along the western slope the most prominent of these ravines is that drained by Flaugherty run, which empties into the Castleman at Meyersdale.

This deep hollow has enabled the Connellsville railroad (Pittsburg division of the Baltimore and Ohio railroad) to climb the mountain slope on a moderately easy grade, and the tunnel at Sand Patch has been cut through the red rocks of Formation IX. It will perhaps be remembered that the Pennsylvania rail-

road tunnel at Gallitzin on the top of this same mountain ridge, though at no greater elevation than the tunnel at Sand Patch, passes through the highest coals of the Lower Productive group, as well as the Mahoning sandstone overlying them. The causes that have produced this change in the mountain crest were enumerated in the Report of Progress for 1875.

The Sand Patch tunnel is not only some distance east of the real crest, but several hundred feet below it. The main crest of the mountain passes over Keystone junction, the precipitous sides of the ravine here rising full 500 feet above the waters of Flaugherty run.

Conglomerate of XII.

A few feet above the bed of the stream the fossiliferous limestone near the base of Formation XI has been discovered, and is now extensively developed. The rocks as exposed in this ravine dip sharply north-westward, inclining at the limestone quarry at an angle of 16°.

The outcrop of the Great Scral Conglomerate skirts the western edge of the mountain top all along its run through Somerset county. This massive formation (XII), the thickness of which cannot here be satisfactorily determined, though it ranges perhaps from 150′ to 200′ thick, sinks rapidly under a thin sheet of coal measure rocks into the Berlin-Salisbury sub-basin.

Such changes in the character of the Conglomerate as were noted along its outcrop on the Allegheny Mountain are similar to those which have been frequently observed elsewhere in connection with this formation. The occasional patches over which the rock appears as a coarse Conglomerate, made up of rounded white quartz pebbles, held loosely together by a silicious cement, are found here as in other places; while large belts were found to prevail, wherein the formation appears as a massive sandstone with each minute grain of sand distinct and separate from the rest, but together forming a compact whole. Sometimes the rock passes by insensible gradations from fine grained to coarse grained, and from coarse grained to the pebbly character, and *vice versa.*

Coal Rocks on the Western Flank of the Mountain.

The accumulation of coal measures on the flank of the mountain is nowhere great in Somerset county. Occasional

evidences of the existence of the lowermost coal beds are found, however, along the western slope all the way from Shade Township to the Maryland line, and partial openings have been made on these beds east of Buckstown, east of Berlin, at Hays' mills, and again east of Salisbury, on the Grandman tract. These coals supply a great local want, but they are of little present importance except for such use.

The eastern flank of the Allegheny Mountain, as confined to Somerset county, is not known as yet to yield any minerals whatever. Search has never been made for the Umbral iron ores (XI), and certainly no coal of importance is known to exist along this flank.

Supposed Nickel Ores.

But in this connection brief mention may be made of some concretionary nodules of greenish limestone which have been found at various intervals along the eastern slope of the mountain in Somerset county.

These nodules, smooth and rounded, vary in size from a filbert to a man's fist, and lie scattered through the thin bedded greenish sandstones of Formation X.

As such they are interesting, as showing that calcareous matter has found its way down through crevices in the rock, or has been deposited at the same time with the sand and partaken of the same greenish cast.

But undue importance has been attached to these nodules, and their discovery a few years ago was the cause of some little excitement in certain parts. By many it was supposed that they represented some form of nickel, and as the notion spread it steadily strengthened. Diggings were instituted along certain horizons, and the nodules were turned out in abundance. It seems almost needless to state that the notion is simply a popular fallacy.

The nodules are found in greatest abundance on the farm of Mr. Burkit, a few miles south-east of Buckstown, and some specimens taken from this place gave the following results on analysis (D. M'Creath.):

" Carbonate of lime	51.921
Carbonate of magnesia	3.639
Carbonate of iron	3.069

Protoxide of manganese	.586
Alumina	3.317
Sulphur	.081
Phosphorus	.102
Insoluble residue	37.940
	100.655"

Negro Mountain Anticlinal.

The course of Negro Mountain, the first anticlinal sub-axis of Somerset county, through Paint, Shade and Stony Creek Townships, cannot be laid down on the map with absolute and positive accuracy. The course as indicated on Plate XIV must therefore be regarded merely as a close approximation to the truth.

This is owing partly to the wildness of the country through which the axis passes, but principally to the great lack of such rock exposures along its line as would afford reliable dips.

A single south-east dip was observed on Paint creek, about two miles above Scalp Level, and an effort was made to connect it with the Negro Mountain anticlinal as identified further south. But the effort failed, and for the reasons just stated. Should further developments ultimately establish this connection, then the expiring anticlinal will pass over into Richland township (Cambria county) at some point between Ashtola and Scalp Level, but die out completely before reaching the Conemaugh.

This, then, still remains a question for future determination; but from facts observed further south it is believed that the accepted geology of the Negro Mountain anticlinal, as originally worked out by Messrs. Hodge and Lesley, requires no material modification or change.

It has been stated already that the high and elevated wilderness-upland prevailing throughout the eastern portion of Paint Township, is due to the close proximity of Negro and Allegheny Mountains, with their dense forests and rocky, barren soils.

The run of the axis throughout this region is somewhat obscure, but it is thought to pass east of Ashtola.

Going south-westward it may first be observed on Shade creek, in the vicinity of Shade furnace. At this place the red rocks of Formation XI emerge above the water.

The axis is next seen at Union Church, on the Stoystown and Bedford pike, two miles west of Buckstown. It is here a distinct and prominent ridge, as seen from Stoystown, and its top is thickly covered with large masses of a hard fine-grained sandrock, representing the upper portion (Piedmont S. S.) of the Conglomerate of No. XII.

From thence in its run south-west, the axis is easily followed, its course being sufficiently indicated by the topography of the country.

The Negro Mountain axis next crosses Stony creek about two miles north-north-west of Shanksville. Here a large portion of the Lower Productive Coal Measures sweeps across the anticlinal arch, and the axis is again seen in the same condition crossing the Bedford and Somerset pike about one mile south-east of Fairview village. In this latitude it is marked by the prominent and distinctive features, by which it is characterized all through the southern portion of the county. Ascending its gently sloping flank from either side, an elevation of 2,500 feet above tide level is reached before its summit is crossed, and when seen from a distance the ridge forms a well defined line against the horizon.

From Fairview village to the Castleman river the Negro Mountain axis runs not exactly, though very nearly, parallel to the Allegheny Mountain.

Thus far it is known locally as "the Ridge," and first assumes the name of Negro Mountain after crossing the Castleman river.

It skirts the western edge of Brothersvalley Township; all along this portion of its line the lowermost coal beds of the Lower Productive series sweep in an unbroken sheet across its top, the smooth, rounded hills plainly denoting the soft rocks of which they are composed. Moreover, the top of the ridge has here been cleared of its forest growth, and for many years has been under cultivation. But near the Castleman river the coal measures have been washed from the top of the anticlinal; the Conglomerate appears in their stead, supporting a stunted growth of pine and hemlock.

Castleman River Gap.

The gap of the Castleman river through Negro Mountain is a deep transverse cut, extending from Garrett station, on the Baltimore and Ohio railroad, to Mineral Point.

This is a distance of nearly eight miles, but the diagonal course of the river increases the apparent width of the mountain, which here does not exceed five miles from base to base.

The Seral Conglomerate rises above the water near both ends of the gap.

It is observed a few hundred yards west of the town of Garrett, at an elevation of about 1,900 feet above tide water at Philadelphia; it at once starts off rapidly for the mountain top, over which it spreads.

The crest of the mountain is full 700 feet above Garrett, and allowing the Conglomerate to go $2\frac{1}{2}$ miles on an air line to the top of the ridge, it thus rises somewhat less than 300 feet to the mile, or has an average dip of about 3°.

At Garrett station the dip is certainly in excess of this figure, but the rocks must flatten as they approach the crest, otherwise lower rocks would there be exposed.

The centre of the anticlinal is at Pine Grove station, near the middle of the gap. The exposures at this place enable the anticlinal to be located precisely, but all through the gap, with few exceptions, the railroad is located in the loose wash and débris of the river, and the exposures are therefore meagre and show little.

No measurement of XI and XII can be obtained along this river bank, nor can a complete section of the Lower Productive Coal Measures be constructed at either end of the gap, a fact much to be regretted.

Both at Mineral Point and at Garrett the presence of all the coal beds of the Lower Productive series has been fully established by actual developments, and the intervals between the beds are therefore known, but the character of the rocks which make up these intervals still remains to some extent unknown. Massive sandstone, however, predominates.

At the centre of the anticlinal, in the gap, the river has cut down to the base of XI. No evidence of X is found at

this place. The band of fossiliferous limestone and heavy deposit of reddish calcareous sandstone are both here exposed just above the water.

Descending the Castleman towards Mineral Point, the Conglomerate is lost below the water before the latter village is reached, but a few boulders of coarse pebbly sandrock, clearly belonging to the Conglomerate of XII, are nevertheless seen on the hill slopes at the railroad station, slopes that are wholly made up of coal measure rocks. These boulders and fragments have doubtless been carried thither from the interior of the gap by the agency of ice or water, and dropped into the position in which they are at present found.

From the Castleman river to the Maryland line Negro Mountain comprises a broad belt of high land, which grows steadily broader and spreads finally far over into Addison township.

The Conglomerate has frequently been entirely swept from the huge back of the anticlinal, and the Mauch Chunk shales (XI) redden the surface on top.

Along the eastern flank the lower coal measures everywhere descend slowly into the basin below. Few openings have been made on these beds, but sufficient has been done to establish their presence. Until very recently no coal was suspected at this elevation, and its discovery will supply such fuel as is required by the farmers of Eastern Addison for domestic purposes and for calcining limestone. Further than this, however, its market cannot now be profitably extended.

CHAPTER II.

Detailed Description of the Berlin-Salisbury Sub-Basin North-east of Shanksville.

East and south-east of Ashtola, Paint township is a wilderness of mountain land. A few acres of land on the top of the Allegheny Mountain have, however, been cleared of timber and are under cultivation.

This is east of the outcrop of the Conglomerate, (XII), in the red shales of Formation XI. The soil is smooth, but lean and poor.

The traces of black slate that have been discovered here from time to time have led the farmers to dig a number of holes on the top of the Mountain in search for coal. The search thus far has been fruitless, but sufficient has been done to prove that the Umbral rocks do not here include a workable seam of coal. A continuation of the efforts in this direction is certainly to be discouraged.

Limestone of XI.

The silicious limestone near the base of Formation XI outcrops a short distance east of the "clearing." It has been opened up and quarried, the coal used in burning the limestone being brought from the mines near Ashtola. A white lime, considerably intermixed with sand, is the product.

It was repeatedly asked by persons in this vicinity why this same limestone does not appear in the neighborhood of Ashtola, and in the region to the west of the latter village towards Scalp Level. The reason is very simple, and is here stated for the information of those who have been vainly looking for it in the valley where it cannot possibly be found. From its outcrop, on the top of the Mountain, it dips steadily north-west towards Ashtola, and disappears at once under the surface,

higher rocks coming in on top, all dipping in the same direction. By the time it has reached the neighborhood of Ashtola, it is several hundred feet below the surface, and the erosion there has not been sufficient to unearth it.

Beds A and B.

In Shade township to the south, a few coal openings have been made in the interval between the Negro and Allegheny Mountains. But the accumulation of coal measure rocks is here nowhere great, and, excepting in the neighborhood of Buckstown, the beds of the streams are at or near the base of the Lower Productive coal series.

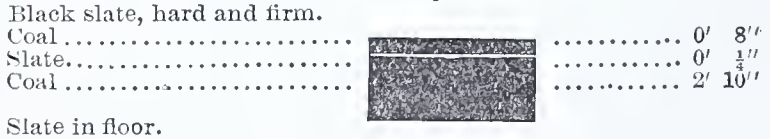
Boulders of a massive sandrock appear in the bed of Dark Shade creek at the mouth of Beaver Dam run. This same sandstone, presumably the representative of the Seral Conglomerate, shows in the run for some distance above its mouth, but disappears ultimately, the Coal Measures coming in above it. Both banks of the run are sufficiently high to include a considerable amount of these "Coal Measures," and on the J. Kuntz farm one of the lower coal beds is mined.

Bed B. (?)—Kuntz's mine lies to the North of the run, and is, by barometer, 80 feet above it. The mine is driven to the northwest, (N. 28° W.,) and rises steadily with the coal, the dip averaging thus far about 3° to the south-east.

The mine is in excellent condition, and a large amount of coal is taken from it, supplying the neighborhood with fuel. It is endorsed as a good, strong steam coal, and is further represented as coking easily in the blacksmith's fire.

The bed shows as follows at the face of the mine:

Fig. 1.



The thin slate parting noticed in the section seems to prevail with more or less persistency throughout the mine, coming in here and there as thin lenticular plates.

The coal has the same rich lustrous color as that seen in M'Gregor's mine to the south-west, and indications would point to the same bed having been opened at both places.

Bed A.—Sixty feet below the mine a spring of water containing both iron and sulphur in solution flows from a well rounded bench, while 100 feet above the mine the smut of another coal was dug out in tilling the soil. Iron ore also occurs embedded in ferruginous shales near the top of the hill. This ore was once worked, and furnished a part of the material on which Rockingham Furnace was run. This old charcoal furnace has long since been out of blast and fallen into decay.

Of the nature, thickness and general character of the ore deposit nothing is now known.

Section on Kuntz Farm.

The following rough section exhibits the benches showing on the hillside to the north-east of the Kuntz mine. (Page plate II, fig. 2.)

Hill top.		
Interval	20′	0″
Ferruginous shales, containing iron ore	from 5′ to 8′	0″
Interval, concealed measures	62′	0″
Bench ?		
Interval	40′	0″
Bench ?		
Interval	40′	0″
Bench, coal.		
Interval	93′	0″
Coal	4′	0″
Interval	58′	0″
Bench, coal ?		
Interval	20′	0″
Beaver Dam run.		

One branch of Dark Shade creek takes its rise on high land about one mile east of Buckstown. The stream flows on a general northerly course, and empties into Shade creek proper just above old Shade furnace.

M'Gregor Mine.—As near as can be ascertained the line of the Negro Mountain anticlinal crosses Dark Shade creek, near old Rockingham furnace, and at M'Gregor's mine, on Dark Shade, four miles east north-east of Buckstown, its influence is plainly felt, the measures inclining to the *south-east.* On M'Gregor's farm it is probably Bed B that is worked, yielding about 3½ feet of coal in the upper bench, as follows:

Fig. 3.

Black slate.		
Coal	3′	6″
Slate		?
Coal		?

The coal is bright and shining; soft, friable, of columnar structure, and reasonably free from the usual impurities.

Directly overlying the coal, at the mouth of the mine, from 6 to 8 feet of black slates are exposed, in which nodules of kidney ore are scattered.

Bed A.—The mine is by barometer 42 feet above the level of the creek, in the bed of which a small seam of coal, 18 inches thick, is said to outcrop.

A well rounded coal bench shows in the hillside, 90 feet above the mouth of the mine.

The synclinal axis of the basin passes a short distance east of Buckstown, and the rocks are almost horizontal where exposed in the neighborhood of the village.

Unquestionably the rocks of the Lower Productive Coal Measures fill the centre of the basin at this point; but the country spreads out in all directions as a broad plateau, with only a few low detached hills, and such coals as it contains cannot therefore be mined by drift above water level in the immediate vicinity of the village.

Heinemeyer Mine.—On C. Heinemeyer's farm, 1½ miles west south-west of Buckstown, the lowest coals of the series outcrop. This is near the summit of Negro Mountain, and the Conglomerate of XII is at daylight, forming the centre of the anticlinal arch and making up the country rock along a narrow belt about one-half mile in width.

At Heinemeyer's the measures dip steeply to the south-east and the coals are lost immediately in going west from this point, but soon descend again from the air on the north-west dip.

The main gangway of Heinemeyer's mine was driven south-east, and has been considerably troubled with water. A cross heading is now being run off to the north-east, or along the strike of the rocks.

The bed yields over five feet of coal, as follows:

Fig. 4.

Roof, black slate.
Coal..... ..... 2′ 8″
Slate, from..... ..... 0′ 1″ to 0′ 2″
Coal..... ..... 3′ 0″
Slate in floor.

The thin slate parting between the two benches of coal occasionally disappears altogether, resulting in a clean breast of rich lustrous coal over five feet thick. This, however, is unusual, for the slate parting was observed to prevail with great persistency.

The coal is hard, with a slight tendency towards columnar structure. Iron pyrites were observed occurring as "binders" or thin plates, and also in the form of rounded masses of variable sizes.

The pyritous coal was further observed to be almost invariably in close contact with the slate parting.

A specimen of the coal was forwarded by Mr. Heinemeyer to the State Laboratory at Harrisburg, yielding there on analysis as follows (D. M'Creath.):

"Water at 225°	.600
Volatile matter	26.000
Fixed carbon	55.683
Sulphur	2.167
Ash	15.550
	100.000

Coke per cent, 73.400; color of ash, gray.

The coal has a bright lustre, is very tender, and carries considerable slate."

If the above specimen represented the average run of the mine, the bed is of decidedly inferior quality.

From the close proximity of the Massive Conglomerate to this mine, it would seem that Heinemeyer works Bed A. Subsequent examination of the benches showing above the mine may serve to identify the coal now worked as Bed B, though the vertical distances between the benches, as obtained by barometer, would rather indicate the presence of Bed A in Heinemeyer's mine.

Section at Heinemeyer's.

Assuming the dip to the south-east to be about 4°, the following section gives the distances between the benches on the hill to the east of Heinemeyer's house (Page Plate II, Fig. 5.):

Hill top.	
Interval; concealed measures	10′ 0″
Bench. (?)	
Interval; broken sandstone and sandy shales on surface	35 0′

Bench. (?)		
Interval; concealed measures	90′	0″
Bench; coal outcrop.		
Interval	50′	0″
Heinemeyer's mine, coal 6′ 0″.		
Interval to small run	10′	0″

Grove Mine, B.—About two miles east south-east of Buckstown a bed of coal measuring in all about four feet thick, has been opened on the western slope of the Allegheny Mountain, near the head waters of Clear Run.

The opening is on the farm of Mr. Samuel Grove. Mining operations are carried on here principally during the winter, when considerable coal is taken out and sold in small quantities at the mine mouth. The coal in the upper bench is of excellent quality; it possesses a bright rich color; it is of columnar structure, very friable, and in appearance seems unusually free from impurities. The bed is divided twice by thin partings of slate, but both of the lower benches are thin and unimportant.

The mine is worked to the north-east, the coal dipping at an angle of 3° to the north-west. The same bed strikes into the hill on the eastern side of the run and continues up the mountain slope, outcropping finally near the summit.

In the mine the following section of the bed was obtained:

Fig. 6.

Black slate	5′	0″
Bony coal	0′	2″
Coal, good	3′	0″
Slate	0′	1½″
Coal	0′	4½″
Slate	0′	2″
Coal	0′	4″
Fire-clay slate.		

The coal disappears immediately under the high land to the west, and again comes to daylight on Heinemeyer's hill.

Bed A.—A small seam of coal said to measure three feet thick was discovered on Clear Run, about fifty feet below the Grove mine.

These coals occupy positions low down in the Lower Productive series, and most probably represent beds A and B.

Stadtler Mine, B.—The most extensively worked mine, perhaps, in this whole section of country, is on Mr. A. Stadtler's

property, close to the summit of the Allegheny Mountain, and about two miles north-east of the Grove mine.

The same bed of coal is wrought at both places, and a comparison of the two sections shows that the bed undergoes almost no change in point of thickness within this distance. And moreover, the general character of the coal remains the same.

The bed has nearly reached its greatest elevation at Stadtlers, and is not far from its final eastern outcrop. The cover over the coal at this point does not exceed fifty feet in any place, but the hard, tough, black slate roof protects the coal from water.

The coal in the upper bench is clean, of rich appearance, and shows bright peacock colors.

The bed showed the following section in the mine:

Fig. 7.

Black slate.		
Coal		3′ 0″
Slate		0′ 3″
Coal		0′ 6″
Slate		0′ 3″
Coal		0′ 8″
Fire-clay slate.		

This being the nearest coal to certain portions of Bedford county, large quantities of it are shipped down the eastern slope of the Allegheny Mountain, and it is everywhere represented as an excellent coal, being much sought after and used by blacksmiths. Coke has been made from it roughly in open air pits, and the article produced was used with entire satisfaction in several foundries in Bedford county.

In an old drift, on this same coal, some five hundred feet west of the present opening, the bed shows an abnormal development measuring in places as much as 6 feet thick, and thinning down again within a short distance to its regular size. No change was noticed in the character of either roof or floor.

Conglomerate of XII, East of Stadtler's Mine.

The mountain flank continues to rise about 100 feet to the summit, and the conglomerate of XII first appears about one-half mile east of Stadtler's mine. The broad crest of the Mountain is thickly strewn with huge masses of this rock; the boul-

ders are chiefly round and smooth, and vary in character from a coarse conglomerate made up of white quartz pebbles, to a fine grained sandstone.

Iron Ore in Wells Creek.

At the "Silver Diggings," two miles above the mouth of Wells Creek, specimens of a rich carbonate iron ore were seen. These had been taken out of a shaft nearly 30 feet deep, put down here many years ago, since which time the pit has filled with water. But these excavations were fresh, and had been but recently made when visited by Dr. Hodge of the First Geological Survey of the State, and are thus noticed in the Final Report.* "Two bands of ore were passed through, the lower of which lying beneath the bed of the creek cannot be worked. The upper, though a small seam, consists of a very pure ore. This is insufficient of itself, but at the upper edge of the shaft there is another layer of ball ore, apparently of ample size, possessing an aggregate thickness of ore equal, we think, to one foot." Specimens of this ore were secured for analysis and yielded as follows: (D. M'Creath.)

"Iron		40.700
Sulphur		.027
Phosphorus		.113
Insoluble residue		10.940
Iron as carbonate	38.000	
Iron as oxide	2.700	
Total iron	40.700	"

This analysis shows an unusually good, rich ore. No estimate can be placed on the value of the deposit until more definite information has been obtained respecting its thickness and probable extent.

Section at "Silver Diggings."

Directly above the creek, current bedded sandstones show in the bank for 20 feet, above which follows a succession of well rounded benches in the following order, reading downwards, (Page Plate II, Fig. 8):

Hill top.	
Fine-grained sandstone, current-bedded, in place	15′ 0″
Bench (?).	
Interval, thin sandstone covering surface	75′ 0″

*Rogers' Final Report, 1858, vol. II, p. 657.

SECOND GEOLOGICAL SURVEY OF PA.

1875

Fig. 2.

N. E. OF KUNTZ MINE.

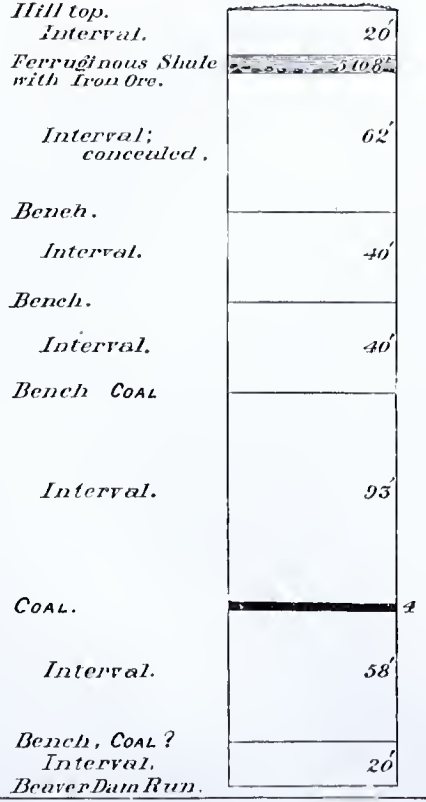


Fig. 5.

HEINEMEYER FARM.

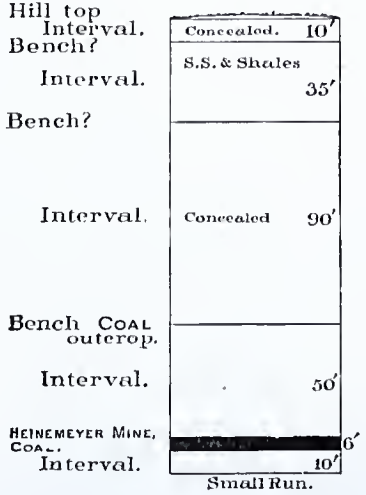
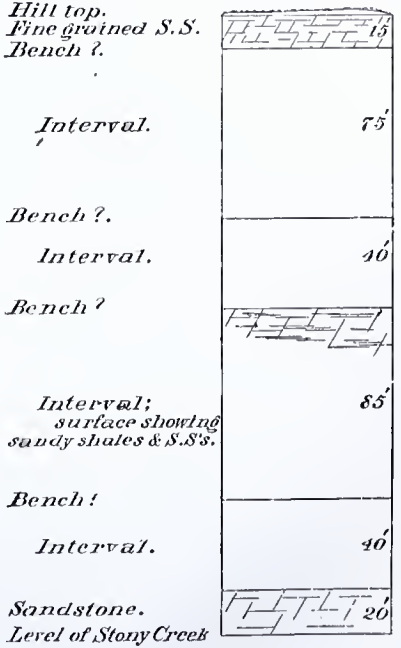


Fig. 8.

SILVER DIGGINGS.



O.B.H.

Bench (?).	
Interval (?)	40′ 0″
Bench (?).	
Interval, showing sandy shales and broken sandstone	85′ 0″
Bench (?).	
Interval	40′ 0″
Current-bedded sandstone, in place	20′ 0″
Stony creek.	

These benches have never been investigated, but probably represent nearly all the coal beds of the Lower Productive series. It is not known whether a subjacent coal seam was passed through in sinking the shaft.

Shanksville Coals.

In the vicinity of Shanksville no coal whatever has yet been worked, although the country round about is clearly made up of the soft rocks of the coal measures, which, descending from the mountain slope, here fill the centre of the basin. This is indicated as well by the general topographical features of the country, as by the total absence of the Conglomerate of XII on the hillsides or in the stream beds anywhere in the vicinity of the town. A hill rises abruptly over Stony Creek, to the south of Shanksville, for 150 feet or more, and shows one well marked and persistent bench, which follows the stream closely in all its turns and windings.

At Shanksville this terrace is seventy feet above the water, and if search after coal be made in this neighborhood it should first receive investigation.

Going east from Shanksville the country rises steadily, though softly. Developments are wholly wanting in this region, and it is not known precisely at what point the different beds of the Lower Productive Coal Measures come out to daylight; these measures, however, all shoot into the air on the western slope of the mountain and leave the Massive Conglomerate (Seral, or Pottsville,) to crown the crest. It may here be mentioned that a promising outcrop of coal was observed in the side of the road about three miles east-south-east of Shanksville.

Descending Stony Creek from the latter place the bed of the stream is observed to fall rapidly.

Shank's Mine.—Assisted by a south-east rise in the measures,

this soon brings to daylight lower rocks than those exposed at Shanksville, leaving the latter high above the water. Thus, on J. Shank's farm, about $1\frac{1}{2}$ miles north-west of Shanksville, a small bed of coal has been opened on the hillside. In elevation the mine is, by barometer, 175 feet above the level of Stony creek at the Shanksville bridge, and the bed opened is most probably also represented at the bridge by the prominent terrace, 70 feet above the water, to which allusion has already been made.

In Shank's mine the coal measures 2′ 10″, with a thin parting of slate near the centre. A deposit of impure fire-clay, 3 feet thick, underlies the coal, and a fine-grained sandstone forms the roof. This sandstone is considerably cracked and broken, and the coal, for the most part, is wet and poor.

The mine is run in to the north-east and continued on this course, the measures inclining softly to the south-east.

About 60 feet above the mine a prettily rounded bench marks the outcrop of a second coal, the thickness of which is unknown. Between Shank's mine and Stony Creek the country falls off gently and exposes nothing.

CHAPTER III.

Detailed Description of the Berlin Region, including also a Description of the Blue Lick Region and Berkley's Mills.

The general elevation of the country increases very little in ascending Stony creek from Shanksville. Indeed, as far as Berlin, and even beyond that point, the country, particularly along the central line of the trough, is an almost dead flat, varied here and there by a few low hills.

The fall in the bed of Stony Creek between Berlin and Shanksville is very slight, and sometimes over wide stretches of country the stream flows slowly through marshy upland.

The region is as thickly settled as any portion of Somerset county; the soil in places is lean, but in the main it is smooth and good, and with proper cultivation yields profitable returns.

Berlin and Pine Hill.

Sufficient has already been said in a former chapter respecting the slow but steady deepening of this basin in going southwestward. The declination in the floor of the basin is very gentle; in fact almost imperceptible over small areas. But between Shanksville and Berlin, a distance of nearly nine miles, the Lower Productive coal rocks have disappeared altogether beneath the surface, and the Lower Barren Measures have meanwhile slowly accumulated to a depth of certainly 350 feet. This, however, expresses the greatest depth of the basin in the vicinity of Berlin. But south of Meyersdale, as is shown in a subsequent chapter, the basin becomes even deeper, and includes a small portion of the Upper Productive Coal Measures.

Although the rocks at Berlin clearly belong to the Lower Barren Measure Group, the term "Barren Measures" does not here strictly apply, for usually this group, embracing full 550

feet of measures, is almost entirely devoid of workable coal seams; but at Berlin an important series of workable coal beds and limestone deposits can be recognized and traced from Berlin to Berkley's mills on the Blue Lick. This is certainly a very unusual condition of things, but one which nevertheless prevails with more or less persistency throughout Somerset county, though in modified shape, wherever the basins are sufficiently deep to permit of an accumulation of Barren Measure rocks.

The coal beds range from one foot to seven feet in thickness; in character taking an equally wide range. Two beds only of the series are of importance in a mining sense; these are the first and third in descending order; the rest are either too small or too slaty to be mined with profit.

Excellent limestone abounds. No less than four distinct bands, two of which are ten feet thick, are present in the neighborhood of Berlin. All of these deposits have been worked in turn, and each has been found to yield, when calcined, a pure white lime.

Berlin Vertical Section (compiled).

It is much to be regretted that a perfectly accurate and complete section of the entire Lower Barren Measure group of rocks cannot be made at any one place in this basin, for such a section would establish at once the precise geological position of the Berlin coals.

But from numerous vertical sections made at other points in Somerset county, the geological horizon of these coals is believed to have been definitely ascertained. The limestone bands of the Barren Measures maintain a regular thickness with greater persistency than the coals, and being thus more easily recognized over wide areas, are the safest guides in identification.

Now the *highest* limestone found at Berlin accords in position with the Elk Lick limestone, which is the *lowest* limestone deposit above water level in the Salisbury region to the south-west, and accepting this identification as correct, the Pittsburg coal bed would then be from 210 to 220 feet above the surface at Berlin.

By means of this connection the compiled section in this basin can be carried without a break from a point about 200 feet above

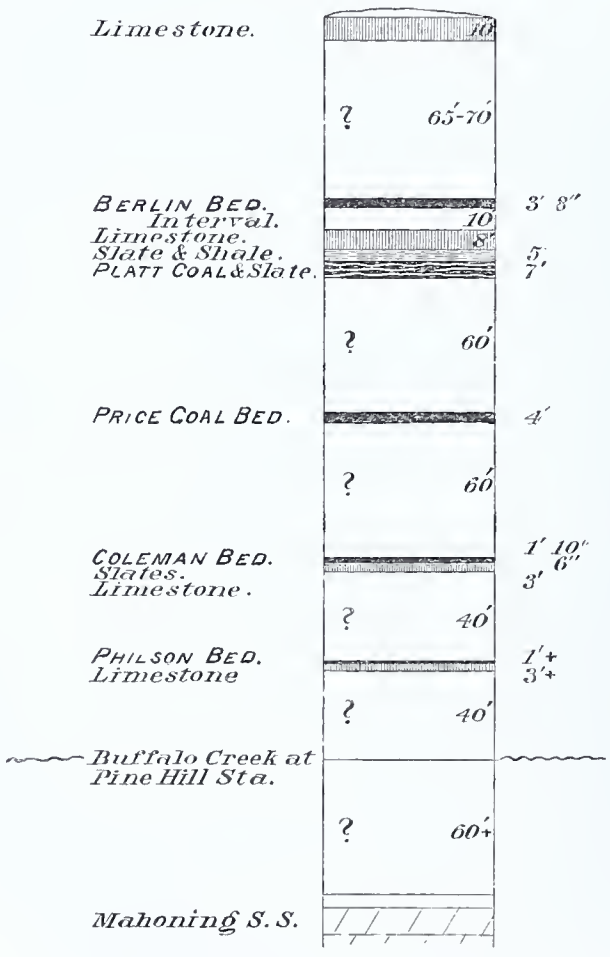
Second Geological Survey of Pa.

1875

Fig 10.

BERLIN.

(Compiled.)



the Pittsburg coal bed down to within perhaps 50 feet of the Mahoning Sandstone; from thence to the Seral Conglomerate the rocks are well known.

The hiatus in the section does not amount to as much as 100 feet, for 500 feet of Barren Measures have been measured, and the group is here certainly not in excess, if at all, of its normal thickness of from 550 to 600 feet.

The developments between Berlin and Pine Hill Church are very complete. By their aid the several coal beds and limestone strata may be easily followed throughout this distance.

The following compiled section shows the several important strata of the Berlin region (as far as known) and the intervals between them as ascertained by careful barometrical measurements. The various local sections are grouped on page plate V, (figs. 11, 12, 13, 14, 15, 16,) the compiled section (fig. 10) appearing on page plate III. This compiled section reads:

Limestone on hill tops	10′	0″
Interval..... from 65′ 0″ to	70′	0″
Coal bed, with slate parting (Berlin bed)	3′	8″
Interval	10′	0″+
Limestone	8′	0″+
Slate and shale	5′	0″
Coal and slate (Platt bed)	7′	0″
Interval	60′	0″
Coal bed (Price bed)	4′	0″
Interval	60′	0″
Coal bed* (Coleman bed)	1′	10″
Slate	0′	6″
Limestone	3′	0″
Interval	40′	0″
Coal bed (Philson bed)	1′	0″+
Limestone	3′	0″+
Interval	40′	0″
Buffalo creek at Pine Hill Station.		
Interval to Mahoning sandstone	60′	0″+

Beaver County Section.

A comparison of this section with that made by Mr. I. C. White in Beaver county,† will be found both interesting and instructive.

Mr. White's section is complete from the Pittsburg bed to the Mahoning Sandstone, and identifying the second limestone

*On Mr. S. Coleman's property this coal bed swells out to a mass of coal and slate nearly 6 feet thick; this, however, is entirely abnormal.

†Report K, p. 75.

deposit (in descending order) at Berlin, with the Crinoidal limestone, the sections are found to correspond more closely than is usually the case with Barren Measure sections.

Berlin Cross Section.

The cross section of the Berlin basin, (Page Plate IV, Fig. 9,) shows the simple geology of the basin so clearly as to need no extended comment.

Philson and Coleman Coal Beds.

Beginning at the base of the scale and taking up the coals in ascending order, the two lowest beds require only a brief notice.

They appear in the flat to the north of Berlin, probably a mile and a-half from the town, but are here almost unknown. Their presence has been detected by their accompanying limestones.

S. A. Philson.—This is the final north-east outcrop; and from thence they descend south-west with the basin, sloping under the town of Berlin. They have been detected, however, in a ravine just east of the town, and the upper of the two beds has there been opened by Mr. S. A. Philson. The coal was not mined at this place, but was exposed in quarrying the limestone below. It shows about $1\frac{1}{2}$ feet thick.

South-west of this ravine high land comes in, and these coal beds remain concealed until again brought to daylight in the valley of Buffalo creek, and in the small ravines projecting upwards from the creek into the sides of the valley.

S. Philson.—On the north side of Buffalo Creek both beds have been exposed on Mr. S. Philson's farm.

The lower bed, 40 feet above Buffalo Creek, was very imperfectly opened up at this place, and its exact thickness cannot be stated. But certainly as much as one foot of coal exists here, and more thorough investigations may reveal a much larger bed. It is underlaid at a short interval by limestone.

Ascending the hill for about 40 feet the outcrop of the next higher coal and limestone is found. The interval between is made up wholly of black slates and soft clay shales. This second coal and limestone has been opened by Mr. Philson in an adjoining field, where they show as follows:

Clay and shale, iron stained	6′ 0″
Coal	1′ 10″
Black slate	from 0′ 4″ to 0′ 6″
Limestone	3′ 0″+

The coal is much intermixed with earthy matter, and is poor and worthless. But if taken out in connection with the limestone underlying, it will serve very well to calcine the latter.

The outcrops of these coals range eastward and westward along the north and south slopes of Buffalo valley, and together with their attendant limestones, have been exposed on a number of farms bordering the creek.

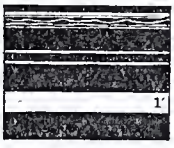
Crossing the creek at Pine Hill station, on the Buffalo Valley Railroad, and ascending the southern slope of the valley, the outcrops of these coals are passed over, both showing plainly in the road.

The lower deposit has never been investigated on this side of the stream, but the upper coal was twice opened on the Coleman farms, and displays a remarkable thickening, swelling out in a short distance to nearly six feet in height.

On Mr. Henry Coleman's land, to the east of the road, a drift was recently started on this bed to test the quality of the coal.

After driving the entry a few yards beyond the outcrop, sufficient had been seen to warrant a discontinuance of the work. The coal, so far as seen, is certainly worthless for all practical purposes. Altogether, the bed measures nearly five feet thick, and shows even thicker on the adjoining farm of Mr. S. Coleman, where a complete measurement was obtained as follows:

Fig. 17.



Soft shale.	
Coal	0′ 3″
Slate, soft	0′ 2″
Coal, bony and poor	0′ 7″
Coal, slaty	1′ 0″
Slate	0′ ½″
Coal	0′ 4″
Slate	0′ ½″
Coal	1′ 3″
Slate	1′ 0″
Coal	1′ 2″
Soft clay in floor.	

The gangway has been driven 150 feet on a general northwest course, and dips slightly. The coal is bony and poor throughout.

Gumbert Quarry.—This same coal again appears on Mr. Gumbert's land, in the neighborhood of Pine Hill Church. The exposure occurs in a small ravine, which widens westward towards Buffalo creek.

No special effort has been made by Mr. Gumbert to develop the deposit, though small quantities of limestone have here been quarried, exposing the following section a few feet above the run:

Shales and slate	6′	0″
Coal smut and dirt	1′	0″
Coal	1′	0″
Slate	0′	7″
Coal	0′	5″
Black slate	0′	8″
Limestone.	2′	0″
Shale	1′	0″
Limestone.	0′	6″+

From thence south-westward to the Valley of the Blue Lick these coals remain under the high country which marks the centre of the basin. They are, however, known to exist in the neighborhood of Berkley's mills, and are described on succeeding pages relating to the latter region.

Price Coal Bed.

The next higher coal of the Berlin series, or the "four foot bed," necessarily covers a more limited area than the beds just described. But it is in every sense a more valuable seam, and is, in fact, one of the two important beds of this region, although yielding a somewhat ashy coal.

The bed is marked by a few distinctive and very persistent features, which materially assist in its recognition.

These may be briefly summed up as follows:—I. Its invariable slate roof. II. The small slate band parting the bed unevenly, and, III. The softness and extreme friability of the coal.

The bed is further parted by small knife edges of slate, which, though non-persistent, are nevertheless of a damaging character. Moreover, it seems at no time to be free from thin wedges of clayey matter, which swell the percentage of ash in the coal. One analysis was made of the coal from this bed and will be found below.

Mr. S. Musser's farm, 1½ miles north north-east of Berlin, is the final north-east limit of the "four foot bed." It starts under the high land at this place, and though provided with very little cover, is nevertheless sufficiently well protected by its roof slates to permit of its being mined almost to the point of outcrop.

On this property the bed is opened near Mr. Musser's house, and shows as follows in the main gangway, a short distance from the mine mouth:

Black slate.	
Coal, including a few thin wedges of slate	2′ 9″
Slate.....	0′ 3″
Coal.....	1′ 10″
Slate.	

A small knoll is all that is here left of the bed, and to the north of Mr. Musser's house it passes out into the air.

The rocks here rise to the *north-west*, towards Negro Mountain, but the *north-east* rise is likewise marked.

The same bed is again exposed on the farm adjoining Mr. Musser to the south-west, and there gives the same section.

Moreover, its outcrop is distinctly marked along the roadside for some distance, the country remaining nearly flat, but is lost in the high ground around Berlin, passing underneath the town. It again appears, however, in the ravines to the east and south, and has been opened in both places.

Brubaker Mine.—That to the east is on the outskirts of the town. The opening on Mr. Brubaker's land is close to the developments of Mr. S. A. Philson on the next bed below, being about 50 feet above Mr. Philson's quarry, and also about 50 feet below the Platt openings on the next higher bed, described further on.

South of the town the "four foot bed" again appears at the railroad station, and has been opened on both sides of the ravine. This point is about the centre or synclinal axis of the basin, for the coal has here been mined both to the north-west and south-east, and shows a slight rise in each gangway.

Price Mine.—The mine on the western side of the ravine is owned by Mr. T. Price, who has opened for a short distance a wide and commodious gangway, preparatory to shipping coal to market.

This gangway would command a large acreage of firm coal. The bed is under all the high plateau south-west of Berlin, and stretches in an almost unbroken sheet towards Pine Hill Station, in Buffalo Valley.

Whether the bed will repay working on a large scale, is a question for practical determination; for these Barren Measure Coals are treacherous, and change suddenly, both in size and character.

At the head of Mr. Price's gangway the section is as follows:

Fig. 18.

Black slate	3′	0″
Coal, bony	0′	2″
Coal	1′	0″
Slate, knife edge.		
Coal	1′	2″
Slate, thin, non-persistent.		
Coal	0′	5″
Slate	0′	3″
Coal	1′	0″
Slate.		

The coal is of columnar structure, and is exceedingly soft and friable, breaking and crumbling considerably in mining.

The 3-inch parting is variable in point of thickness, becoming at times much reduced in size and thinning down to one inch.

An average specimen of the coal was here obtained for analysis, and gave the following constituents (D. M'Creath.):

"Water at 225° Fah	.870
Volatile matter	20.330
Fixed carbon	68.944
Sulphur	1.176
Ash	8.680
	100.000

Coke per cent, 78.80; color of ash, gray.

The coal is bright, tender, and shows a few scales of iron pyrites and some slate partings."

Following the outcrop of this bed down Buffalo Creek, it is found to skirt both sides of the valley, keeping far above water level and shooting out into the air on a north-west rise some distance below Pine Hill station.

The outcrop runs up the ravines, and the coal was once mined in the hollow which starts near Mr. Weighley's house. This mine, however, is now closed up.

Philson Mine.—The same bed is also known in the next ravine to the west, extending northwards through Mr. Philson's fields.

A drift was here run in on the bed, and a small amount of coal was taken from it; but the opening has since been allowed to fall shut. The bed measures at this place full four feet from roof to floor, and is reported to have shown its usual parting of slate. Ten feet of slates and sandy shales overlie the coal at the outcrop.

Further up the ravine the bed was again opened on Mr. Philson's farm, and these openings are, by barometer, 60 feet above the next coal below, and also 60 feet below the next coal above, as developed by Mr. Hay. These measurements do not correspond precisely with those made at Berlin, but the slight difference is doubtless due partially to defective leveling of the barometer, and partially to slight variations in the thickness of the interval rocks.

The grouped sections of the Berlin region, as given on Plate V, show the general harmony of the vertical sections made in different parts of the basin, and at the same time indicate the comparatively wide variation in interval rocks which is yet entirely compatible with average regularity.

On the opposite side of the creek this bed has been exposed by the Messrs. Coleman on two adjoining farms. These mines are now shut, but the outcrop of the bed can be located without difficulty, being usually marked by a prominent bench.

At Pine Hill Church it is far below the surface, but appears in Mr. Gumbert's fields to the west. The outcrop is at the base of a wooded hillside, and is just at water level. Dipping southeast under the hill, it could not be worked at that place.

Platt Coal Bed.

The largest coal bed of the Berlin group is the next seam in ascending order above the "four foot coal" just described. Including all its partings it is seven feet thick.

This is the so-called "Platt vein," having been developed many years ago close to the town by Mr. Platt. At that time this was the only bed of coal known to exist in this region.

The bed is now no longer worked; it consists of a mass of

coal and slate so closely intermixed as to render the whole deposit almost totally worthless. Besides, it carries enormous quantities of sulphur, as is shown by the analysis of a specimen of the coal obtained through Mr. Weighley.

A large number of sections made between Berlin and Pine Hill Church shows that this bed ranges through the hills at an average distance of about 60 feet above the "four foot seam," and about 25 feet below the highest workable coal of the Berlin group.

The close proximity of these two upper coals has been the cause of some confusion in the proper identification of the outcrops of the beds. Apart from the wide difference in the character of the coals, the beds may be easily recognized and located by the limestone bands which range through the hills, and also by the invariable interval of 25 feet separating the coals.

Starting at the northernmost point and following the Platt bed south-westward, it is first seen in the ravine to the east of Berlin, where it appears close to the surface.

Platt Mine.—The coal was benched by Mr. Platt, but work was discontinued at this place long ago, and the exposures are now no longer fresh. A section of the bed was, however, obtained, and is here inserted. It reads as follows:

Shale.		
Coal, bony	1′	6″
Slate	0′	2″
Coal	0′	3″
Slate	0′	6″
Coal, poor	2′	0″
Slate parting	0′	1″
Coal, poor	1′	0″+

The bed then disappears under the town of Berlin, but is only a short distance below the surface at the eastern end of the village.

It is again seen in the road leading to the railroad station, outcropping about midway between the water trough and the station. The outcrop is here obscure, having never been developed.

Weighley Mine.—Its outcrop ranges high up along the hill slopes of Buffalo valley, passing far up the ravine leading to-

wards Mr. Weighley's, and was opened within a few yards of the latter's house.

But the coal was not worked to any extent, and the mine was allowed to fall partially shut. A portion of the bed was, however, seen at this place by Mr. Chas. A. Young, who reports the following section:

Black slate.	
Coal	1′ 2″
Slaty coal	1′ 0″
Coal	2′ 0″

The slaty coal, as described by Mr. Young, is virtually a parting, the slate binders frequently uniting and swelling to six inches in thickness.

Moreover, the black slate in the roof is said to be only 6 inches thick, and constitutes a second parting, being overlaid by 1′ 6″ of coal.

An analysis was made by Mr. A. S. M'Creath of a fair specimen of coal from this mine, with the following results:

" Water	1.000
Volatile matter	18.175
Fixed carbon	53.521
Sulphur	5.384
Ash	21.920
	100.000

Coke per cent, 80.825; color of ash, pink.

The coal has a dull lustre; is compact, with a tendency to break into blocks; it carries a considerable quantity of slate and a very large amount of iron pyrites."

The above analysis needs no comment.

Hay Mine.—From Mr. Weighley's mine the outcrop of this bed runs a short distance down the southern bank of the ravine; turns then sharply to the south-west, keeping close to the top of the hills, and is again found at the head of the next ravine, where it has been opened on the township road by Mr. Henry Hay, about 800 feet south-west of his house.

The gangway was driven in only a few yards, exposing the following section:

Fig. 19.

Sandy slate	4′	0″	
Coal, bony	0′	7″	
Fire-clay shale	0′	2″	
Coal, bony and poor	0′	10″	9′ 0″
Parting	0′	1″	
Coal	2′	3″	
Clay parting	0′	3″	
Coal	0′	10″+	

West of Mr. Hay's mine the coal very soon disappears into the air, but following it south-westward it is found underlying the high country between Buffalo Creek and Pine Hill Church. It outcrops on Mr. S. Coleman's farm, a few hundred yards south-west of the latter's house. The bed there appears just below the massive limestone band, which furnishes an unfailing guide for its identification.

At Pine Hill Church the bed is not known, but it certainly passes underneath the village, and doubtless outcrops somewhere in the clump of woods to the west, between Mr. Fritz's mine and the base of the hill.

From thence it passes south-westward into the Blue Lick region and has there been exposed.

Berlin Coal Bed.

The most valuable of the Berlin coals is the highest bed of the section. It measures only about four feet thick from roof to floor, but its comparative freedom from sulphur and slate renders it pre-eminently the first and most important bed of this region.

The area covered by it is small. North of Buffalo creek it approaches the surface so closely, preparatory to its final disappearance from the basin, that very little firm coal could be obtained from it in the vicinity of Berlin. Beyond the smut of its outcrop it is therefore almost unknown between Berlin and the Buffalo. But south-west of the valley, though confined to a narrow line along the centre of the trough, it sweeps in an almost unbroken sheet past Pine Hill church, down the valley of the Blue Lick, going under water level at Meyersdale, to remain concealed beneath the bed of the Castleman river, beyond the

Maryland State line. It is 280 feet, more or less, below the Pittsburg bed as mined in the Salisbury basin further south.

A band of slate divides the bed unequally. This parting, nearly six inches thick, ranges near the overlying slate, and the upper coal bench is therefore usually left in the roof of the mines. The lower bench presents a breast of clean, pure coal, between three and four feet thick. The coal is of a rich lustrous appearance; it is soft, very friable, and of prismatic structure.

The bed underlies a portion of the town of Berlin, and is first seen at the water trough on the road to the railroad station. This is at once its extreme northerly and easterly outcrop.

Thence it ranges along the road leading south-west from Berlin, being there only thinly covered, and is again seen near Mr. Kimmel's house; the outcrop is here marked by a rich show of coal smut and black slates exposed on the flank of a bench. At Kimmel's the bed is about 70 feet below the highest limestone of the section.

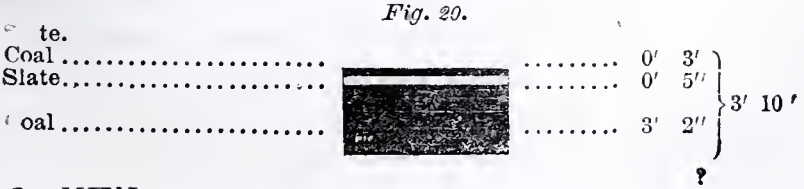
Continuing south-westward past Mr. Weighley's house, the bed is again seen in a ditch, just beyond which the road crosses a high bench, and on the south side of the bench Mr. Henry Hay once opened this Berlin bed, which is here under sufficient cover to be mined for local use. The mine is now entirely shut; the thickness of the bed is given as full four feet.

The bed is about 30 feet above the next coal below, as opened by Mr. Hay 250 yards to the west. Mr. Hay's farm is about the extreme southern limit of the upper bed, before it crosses the Buffalo, and passes under the high land on the opposite side of the creek.

Crossing the stream the bed is found in the highest fields of the Coleman farms, and is there under ample cover.

H. Coleman.—It is mined by Mr. Henry Coleman, in limited quantities, for local use, the bed presenting a handsome appearance in the mine. It shows:

Fig. 20.



A specimen of the coal analysed as follows at the Laboratory of the Survey (A. S. M'Creath.):

"Water	2.010
Volatile matter	20.535
Fixed carbon	68.321
Sulphur	.744
Ash	8.390
	100.000

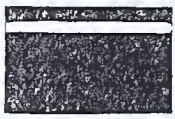
Coke per cent, 77.455; color of ash, gray, red tinge."

On Mr. S. Coleman's farm, to the west, the hills are of about the same elevation, the two farms being separated by a narrow ravine drained by Pine Hill run. The upper coal bed, therefore, appears on Mr. S. Coleman's property.

It passes under Pine Hill church, and comes out in the ravine to the west, being there opened and mined by Mr. S. P. Fritz. By barometer it is about 70 feet below the level of the village.

In Mr. Fritz's mine, the section of coal exposed is as follows:

Fig. 21.



Slate.		
Coal	0′ 8″	4′ 9″
Slate	0′ 5″	
Coal	3′ 8″	
Slate.		

A small coal was accidentally discovered directly above the roof-slate.

An analysis of a specimen of the coal from the main bench of the bed gave the following constituents (A. S. M'Creath.):

"Water at 225° Fah	1.625
Volatile matter	22.760
Fixed carbon	67.467
Sulphur	.803
Ash	7.345
	100.000

Coke per cent, 75.615; color of ash, reddish gray."

From Pine Hill church this bed sweeps south-westward, and is one of the important features of the Blue Lick region.

Berlin Limestone Group.

Very little remains now to be said respecting the limestone deposits occurring in the Berlin group of rocks. Like the

coals, they are confined to a narrow belt of land in the centre of the trough, and their north, east and west outcrops are marked with sufficient distinctness to clearly define their geographical limits.

It has been stated that four bands of limestone range through the high plateau between Berlin and Pine Hill. The following table shows the thickness of the interval rocks separating the several layers:

Limestone, No. IV, *Elk Lick*		10′	0″	
Interval	from 80′ 0″ to	90′	0″	
Limestone, No. III	from 8′ 0″ to	10′	0″	
Interval		135′	0″	291′
Limestone, No. II		3′	0′	
Interval		40′	0″	
Limestone, No. I		3′	0″+	

Limestone No. IV, Elk Lick.

The uppermost limestone touches only the highest knobs, and is very little known.

North of Buffalo creek it is represented by a single knoll which rises westward from Mr. E. Kimmel's house. The limestone caps the hill, and has only a few feet of cover.

The stone being much broken, is easily quarried. It is of a bluish cast, moderately pure, and produces a white lime. A thin layer of red dirt is seen directly above the limestone.

In the Blue Lick region this limestone deposit is overlaid by a thin seam of coal, which has been completely eroded from the northern end of the plateau.

South of the Buffalo, the highest limestone stratum runs along the extreme hill-tops, and just touches the surface at Pine Hill church. Its outcrop is plainly marked on both the Coleman farms, but it has never been opened up in this interval, inasmuch as equally good limestone can be obtained lower down the slopes.

Limestone No. III.

The next lower limestone of the series, (No. III in ascending order,) is a large compact band, from which all the lime needed for the Berlin region could be easily derived. Hitherto it has been very little developed either north or south of the Buffalo, attention having been principally directed to the limestone bands found still lower in the measures.

At Berlin its thickness certainly amounts to as much as 8 feet. It is semi-crystalline, of a bluish color, slakes easily, and produces a good white lime.

Passing underneath the town of Berlin it outcrops in a spring at Mr. Kimmel's house, the water of the spring giving abundant evidence of its presence.

From thence its line of outcrop keeps east of the road and soon makes a wide sweep southward, passing Mr. Weighley's house, and covering the tops of the hills overlooking Buffalo creek from the north. In one of these fields it has been opened by Mr. Weighley, and a small amount of limestone is taken out. It is almost destitute of cover, and the deposit is much cracked and broken.

This limestone deposit passes between the mines of Mr. H. Hay, and then runs westward to outcrop finally in Mr. Hay's fields.

South of the Buffalo its presence has been detected in a small ravine extending up from Pine Hill run, through Mr. S. Coleman's property. It is here as much as ten feet thick.

The same deposit shows on Mr. Henry Coleman's farm, where it has been partially opened and as much as four feet of excellent limestone exposed. It has here been quite extensively developed, the limestone being burned in a substantial kiln near by. The quarry is only a short distance from Mr. Hay's upper mine, underlying the latter by about 10 feet.

The same limestone is also known on the S. P. Fritz farm, in the ravine sloping west from Pine Hill church. It has here been again partially exposed, but its entire thickness was not ascertained.

The two lower limestone bands, (Nos. I and II,) are inferior in thickness to those just described. They cover, however, a much greater area, and are found associated with coal seams sufficiently large to furnish the necessary fuel for calcining.

The outcrop lines of these deposits have already been sufficiently indicated in describing the run of the coals overlying them. It is now only necessary to add what little is known of their thickness and character.

The upper of the two deposits has been exposed on Mr. S. A. Philson's land, to the east of Berlin. It is here separated

by thin partings of shale into three layers, which together aggregate about three feet of limestone. The limestone is of a bluish color, but somewhat argillaceous. It produces, however, a tolerably good lime.

The other deposit outcrops lower down the ravine, but has never been explored.

The upper band is again quarried a short distance below the railroad station, and both deposits are exposed on Mr. Samuel Philson's farm, one mile to the south-west. They are here about 3 feet thick, and are somewhat impure.

They are further known on the opposite side of the creek, the upper stratum having been seen on Mr. Gumbert's land, a short distance west of Pine Hill church, as already described. (See ante page 26).

Valley of Blue Lick Creek.

Blue Lick Creek is an affluent of the Castleman, coming into the latter between Meyersdale and Garrett. It is a small stream, but drains a deep, wide valley.

One branch of the Blue Lick heads up in the high plateau at Pine Hill; it flows a southerly course and joins the other fork, which heads at the base of the Allegheny Mountain and comes down past Hays' Mills, a short distance below Berkley's Mills in Summit township.

The Berlin rocks make up the sides of the valley drained by the Pine Hill branch, which starts at the horizon of the highest limestone of the section, descends quickly, and at Berkley's Mills, $3\frac{1}{2}$ miles south-south-east of Pine Hill, is at the base of the group.

The Hays' Mills branch flows principally over rocks belonging to the Lower Productive System. It turns westward at Hays' Mills, thus crossing over into the Barren Measure region, but it at no time touches even the lowest rocks of the Berlin group.

Blue Lick Creek proper, from the junction of its two forks to its mouth, flows in the Barren Measures below the Berlin group of coals.

The Berlin section, as already given, applies without modification to the measures exposed along the Pine Hill branch of

Blue Lick. The narrow strip of country there covered by these rocks is sharply defined to the east and west.

The old Countryman farm may be said to mark the eastern limit of this coal territory, and the property owned by Mr. Josiah Walker is its western border. The boundary lines of the lower part of the group may stretch somewhat beyond the points designated, but the extreme eastern and western limits of the most valuable of the Berlin coals have certainly been given.

At Pine Hill church the rocks dip south, the incline, though slight, being nevertheless sufficiently steep to interfere with mining in the direction of the dip.

The highest limestone of the section, as has been stated, scarcely touches the country in the immediate neighborhood of the church, but misses it only by a few feet. Isolated patches of the limestone may, however, occur in the few knolls which here rise somewhat above the general surface.

But descending into the valley, and going south-south-east, this limestone gets under cover and is found on the Boger and Wm. Walker farms, about one mile distant from the church It is quarried on both properties, the coal bed seventy feet below furnishing the necessary fuel for calcining the stone.

On the Wm. Walker tract the whole deposit, including the small overlying coal seam, is handsomely exposed, and thus shows:—

Coal smut	1′ 0″	
Clay and dirt	2′ 0″	
Limestone	1′ 0″	
Limestone clay	1′ 0″	10′ 6′
Limestone	1′ 6″	
Shaly parting	thin.	
Limestone	4′ 0″	

The entire thickness of this lowest layer is reported by Mr. Walker to be full 6 feet. The limestone is compact, of a bluish cast, and fossiliferous; it has a slightly conchoidal fracture and calcines easily, yielding a moderately pure white lime.

The quarry is about 90 feet below the level of Pine Hill church; barometrical measurements place this latter point almost on a dead level with the town of Berlin.

From Mr. Walker's quarry the limestone stretches eastward across the ravine, and is claimed to have been found on the

Countryman farm. It has there a south-east rise, and speedily vanishes into the air.

J. Walker.—It likewise spreads westward from Mr. Walker's quarry, rising in that direction and going out to daylight finally on the adjoining farm, owned by Mr. Josiah Walker. It has here been exposed near the final crop, and shows as follows:

Limestone, fossiliferous	1′	7″	5′1″
Shale	0′	9″	
Limestone	2′	9″+	

Both these bands are filled with minute bryozoa and univalve shells.

The two highest coals of the Berlin group have both been developed on the Walker farms.

Both beds pass under Pine Hill church, the highest seam underlying the surface at the village by from 50 to 70 feet. From the church they stretch down the ravine, separating the Wm. Walker and Countryman farms, outcropping on both sides of the hollow, and are represented in the extreme hill-tops of the basin west of Berkley's Mills, though the highest coal is there almost devoid of cover. It therefore offers its best chances at the northern end of the ravine.

Berlin Coal Bed.

As at Berlin, so in the Blue Lick Valley, the highest coal bed of the section is the important one of the group. It preserves the characteristic features already enumerated as distinguishing it in the Berlin region, and it further maintains the same general thickness.

The bed shows handsomely on the Wm. Walker property. It is here under considerable cover, and the coal comes out clean and dry. It seems, however, rather more sulphurous than on Buffalo creek, but it carries less slate, and the quality of the coal, on the average, is about the same. It has been quite extensively mined by Mr. Wm. Walker, the gangways of whose mine are of considerable length. The bed has shown itself regular and even; it is unusually free from "rolls" and other disturbances, and being here close to the synclinal axis, is easily mined.

This coal was largely used in the engines employed in the construction of the Sand Patch Tunnel on the Allegheny Mountain, thus receiving an excellent practical test, the result of

which was to establish for it a reputation as a superior steam coal.

W. Walker Mine.—The following section of the bed was obtained in the main gangway of Mr. Walker's mine:

Slate.

Fig. 22.

Coal	0′ 6″	4′ 3″
Slate	0′ 6″	
Coal	3′ 9″	
Slate	?	

The upper bench is not mined, in consequence of the crumbly slate roof above. This bench ranges from 6 inches to 1 foot 4 inches in thickness, but the coal is inferior in quality to that below the parting.

The lower bench is without persistent partings, but shows occasional knife edges of slate. The coal is soft, friable, and of a rich black color.

A specimen for analysis was forwarded to Harrisburg by Mr. Walker, and there showed the following constituents (A. S. M'Creath):

"Water	1.945
Volatile matter	21.935
Fixed carbon	68.554
Sulphur	1.161
Ash	6.405
	100.000

Coke, per cent, 76.120; color of ash, reddish gray."

J. Walker Mine.—Crossing westward on to Mr. Josiah Walker's farm the same bed is again seen at the head of a small ravine near Mr. Walker's house.

It is here near its final crop, and seems somewhat impure, carrying not only more sulphur, but also more slate. The following section shows the position of the slate partings:

Coal	1′ 2″	5′ 3½″
Slate	0 6	
Coal	0′ 2½″	
Slate	0′ ½″	
Coal	2′ 2″	
Slate	0′ ½″	
Coal	1′ 2″	

Slate floor.

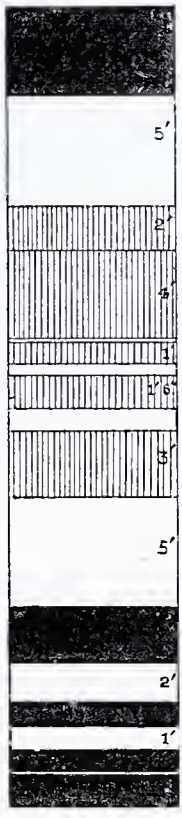
This coal bed rests on a large deposit of limestone, full twelve feet thick, and perhaps even thicker. The limestone is

in turn underlaid by a large mass of coal and slate, corresponding to the Platt-Weighley seam of Berlin.

Section on Wm. Walker Farm.

The entire deposit is handsomely exposed at one point on Mr. Wm. Walker's farm. It has also been found on adjoining farms to the east, west and south, but on none of these is the exposure so complete. The section is as follows, reading downwards:

Fig. 23.



Coal		4′ 0″+
Interval, slate (?)	5′	From 3′ 0″ to 5′ 0″
Limestone, broken	2′	2′ 0″
Limestone, in one band	4′	4′ 0″
Shale parting		thin.
Limestone	1′	1′ 0″
Slate	1′ 6″	0′ 6″
Limestone		1′ 6″
Shale and impure limestone	3′	1′ 0″
Limestone		3′ 0″
Shale	5′	5′ 0″
Coal smut		2′ 6″
Slate	2′	2′ 0″
Coal		1′ 10″
Black slate, hard	1′	1′ 0″
Coal		1′ 0″
Slate		0′ ¼″
Coal		1′ 6″
Slate.	Total	27′ 4¼″

Countryman Farm.

The limestone and coal underlying are again seen some distance back of the hill, skirting the eastern side of the ravine. This is the old Countryman farm, which includes within its boundary lines a considerable amount of the upper strata of the Berlin group.

The highest coal, however, does not seem to have here been opened, although it is known to underlie a portion of the farm.

But a drift was run in on the bed next below, at its outcrop, near the Countryman house. This mine in time falling shut, an opening on the so-called "four foot bed" was substituted for it.

Price Coal Bed.—The latter seam is here not so thick as at Berlin, nor is the coal from it so good. It carries more aluminous matter, the bed being divided into three benches by persistent bands of slate. A section made in Mr. Countryman's mine is reproduced. It reads as follows:

Slate.		
Coal	1′ 8″	
Slate	0′ 2″	
Coal	0′ 2″	3′ 2″
Slate	thin.	
Coal	1′ 2″	

Berkley's Mills.

This Price coal bed is not known on the Walker farms, being there below water level, but is seen farther down the valley, on Mr. Perry Berkley's property, about one mile north of the village of Berkley's Mills. It shows here almost the same section as that obtained on the Countryman farm, as follows:

Slate.		
Coal, slaty	1′ 9″	
Slate	0′ 2″	
Coal	0′ 1″	2′ 11″
Slate	thin.	
Coal	0′ 11″	

The outcrop, running south-westward, crosses the township road, and was opened between the school house and Berkley's mills. The mine is now shut.

The bed runs down the Blue Lick valley on a southward course, turning finally westward, and continuing on to the Castleman.

But on Mr. P. Berkley's land the coal is provided with sufficient cover to allow the next higher seam to appear, together with its overlying limestone, which latter deposit caps the hill.

This same state of things continues south-westward across the township road and past Mr. F. P. Walker's house, by whom both coal and limestone have been opened.

Platt Coal Bed.—Only a part of the slaty bed is mined by Mr. F. P. Walker, but nearly the whole seam has been exposed by Mr. Berkley, as follows:

Slate.		
Coal	0′ 7″	
Slate	0′ 2′	
Coal	0′ 5″	
Slate	0′ 3″	4′ 8″
Coal	0′ 2″	
Slate	0′ 7″	
Coal	2′ 6″+	

This coal is thus seen to retain its slaty character throughout the entire region, beginning at Berlin at the Platt openings, and ending a few miles north of the Castleman river.

But the limestone deposit overlying this coal seam is an important stratum all along the Pine Hill branch of Blue Lick. It furnishes the fertilizing material for the great bulk of the farms in this community, and being near the summit of the platcau at the southern end of the ravine, it has little cover over it, and can hence be quarried at a less cost than the smaller bands found at lower levels.

It shows on the F. P. Walker farm, at the extreme hill-top; a portion of the deposit remains here unexposed, but that seen is as follows:

Surface soil	7′ 0″	
Limestone	0′ 6″	
Clay	0′ 5″	
Limestone	1′ 5′	14′ 1″
Fire-clay slate	2′ 3″	
Limestone	2′ 6″	
Fire-clay, impure	?	

This quarry is close to the centre or deepest part of the basin, and being one of the most elevated points in this vicinity, the highest limestone of the Berlin section is here gone from the plateau altogether, but comes in again south of Berkley's mills, and is present in the hills overlooking Meyersdale from the north.

Berlin Coal Bed.—The outcrop of the highest coal occurs in the road near the School House. It is here provided with only a small amount of cover, and the coal is therefore of little consequence.

Section at Berkley's Mills.

Deseending east-south-east from Mr. F. P. Walker's quarry, by the road to Berkley's mills, the basset edges of 250 feet of rocks are crossed. These are the lower roeks of the Berlin group, as the following seetion shows:

Limestone on hill-top.	
Interval	22′ 0″
Coal; mined by F. P. Walker. (Platt-Weighley seam of Berlin).	
Interval	70′ 0″
Coal; old mine near school-house (Price coal)	4′ 0″
Concealed rocks	60′ 0″
Limestone outcrop. (Coleman coal.)	
Interval	80′ 0″
Blue Lick creek at Berkley's mills. Total	236′ 0″

In this last interval of 80 feet the lowest coal and limestone of the Berlin section should make their appearanee, but their outerop is conecaled.

Between Berkley's mills and the Castleman river at Meyersdale, the country is high upland unbroken by ravines. Such scanty outcrops of coal as occur along the plateau, belong either to the very highest seams of the Berlin section or to other beds still nearer the Great Pittsburg coal at the top of the Barren Measures.

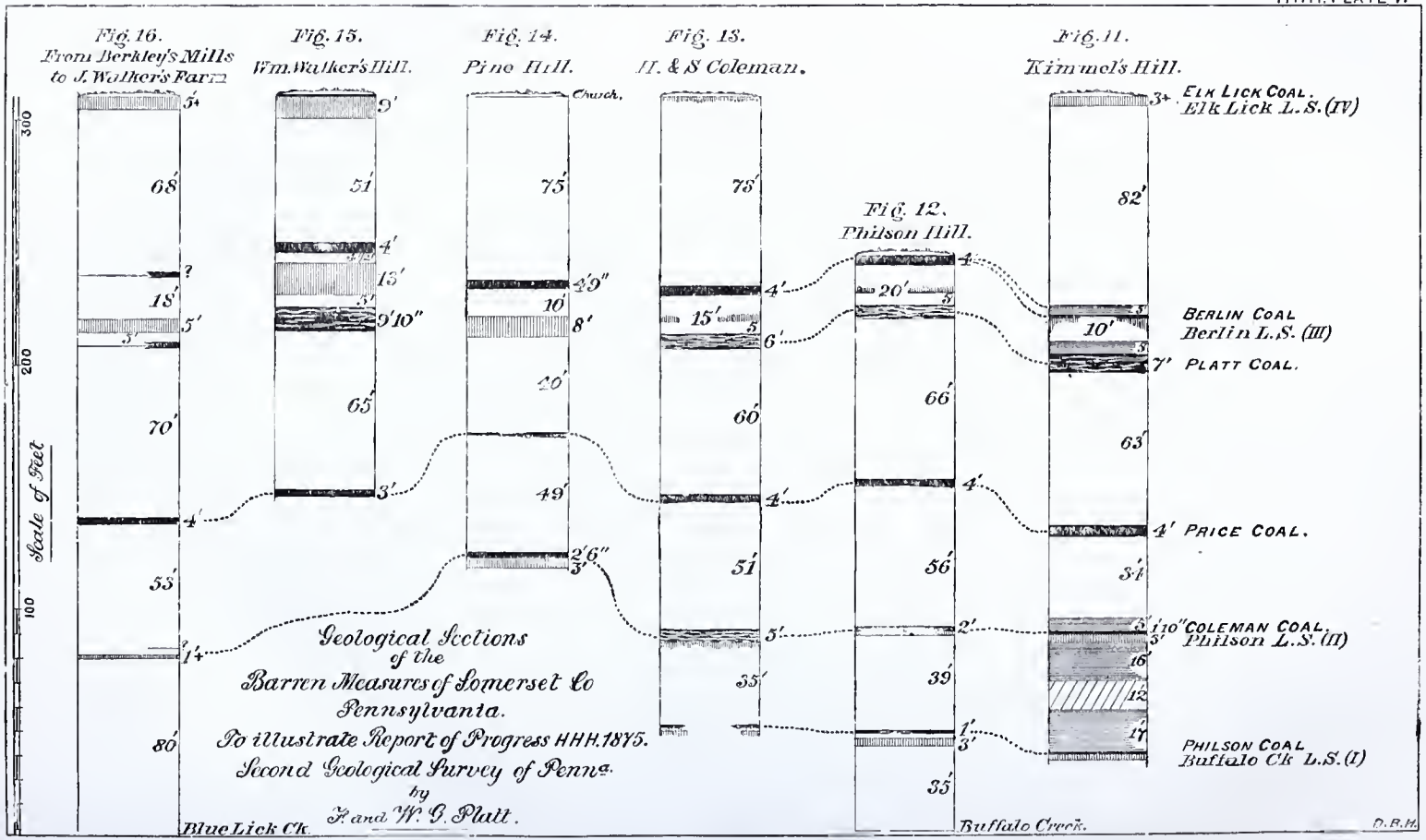


Fig. 16.
From Berkley's Mills to J. Walker's Farm
Fig. 15.
Wm. Walker's Hill.
Fig. 14.
Pine Hill.
Fig. 13.
H. & S Coleman.
Fig. 12.
Philson Hill.
Fig. 11.
Kimmel's Hill.
Scale of Feet
300
200
100
5'
68'
?
18'
5'
3'
70'
4'
55'
?
80'
Blue Lick Clk.
9'
51'
4'
15'
3'
9'10"
65'
3'
Church.
75'
4'9"
10'
8'
20'
49'
2'6"
3'
75'
4'
15'
5'
6'
66'
4'
51'
5'
35'
4'
20'
5'
66'
4'
56'
2'
39'
1'
3'
35'
Buffalo Creek.
3'
82'
10'
3'
7'
63'
4'
31'
5'
3'
16'
12'
17'
ELK LICK COAL.
Elk Lick L.S. (IV)
BERLIN COAL
Berlin L.S. (III)
PLATT COAL.
PRICE COAL.
1'10" COLEMAN COAL.
Philson L.S. (II)
PHILSON COAL
Buffalo Clk L.S. (I)
Geological Sections
of the
Barren Measures of Somerset Co
Pennsylvania.
To illustrate Report of Progress HHH. 1875.
Second Geological Survey of Penna.
by
J. and W. G. Platt.
D.B.H.

CHAPTER IV.

The Lower Productive Coal Measures between Shanksville and the Castleman River, in the Berlin-Salisbury Sub-Basin.

The Lower Productive Coal Measures in the region between Shanksville and the Castleman river are confined to those portions of the basin lying close to the mountain ridges enclosing it on the east and west.

Descending from the Allegheny Mountain, they plunge far beneath the high Berlin plateau and do not again reappear until near the base of Negro Mountain; the eastern flank of which they then slowly ascend, a portion of them sweeping completely over the top, into the Somerset sub-basin to the west; this continues nearly as far as to the Castleman river, where the Pottsville Conglomerate appears on the mountain top and crowds them into the air, as already described. The Berlin cross section (Page Plate IV) shows the main structural features of this part of the basin.

Excepting in the neighborhood of Garrett, at the eastern base of Negro Mountain, few developments have been made on the coal beds and other valuable strata belonging to this Lower Productive group, within the limits of the region under discussion. And these developments (again excluding Garret) are of such a character as to render inadvisable any attempt to harmonize the beds, either partially opened or claimed to be known, with those existing in the same measures elsewhere. This Report will, therefore, not commit itself to positive identifications in this region, excepting along the Castleman river and Buffalo creek, where the developments are far more complete. But sufficient has been done at two points along the western base of the Allegheny Mountain to establish beyond peradventure the presence of at least a portion of this Lower Productive group of rocks above water level.

These localities are Engle's mill, (Altfather farms,) nearly due east of Berlin, and Hays' Mills, about $1\frac{1}{3}$ miles east-north-east of Berkley's Mills.

Engle's Mill.

Engle's mill is situated near the headwaters of Buffalo creek, which here flows a south-west course, close to the foothills of the mountain. The mineral developments already made in this vicinity are principally on the Altfather tracts, and are confined to the eastern bank of the stream. Skirting the eastern bank is a connected line of low hills, not more than 70 feet high, which join on almost directly to the flank of the Allegheny mountain. It is in these low hills that the coal has been found.

It may be stated at once that the area of workable coal in this neighborhood is small, and east of the creek the coal is of little present importance, except for the local market or to transport eastward across the mountain into the valley below; while the six-degree dip, at which the measures here incline north-westward, sends the rocks under the water at too rapid a pace to allow of their being followed at all by drift in that direction on the opposite side of the creek. Under this dip the accumulation of rocks is very rapid, and the high hills west of the mill contain the entire group of the Lower Productive rocks, but the coal beds there above water level are inaccessible by drift, excepting along their lines of outcrop.

By the agency, also, of this sharp tilt in the rocks, the coal beds are soon lost in ascending the mountain flank, and the Pottsville Conglomerate is at daylight long before the summit has been reached.

This is, in brief, the general condition of things at Engle's mill.

D. Altfather Mines.—Concerning the developments made by the Messrs Altfather, two of the coal openings are found a short distance south-east of Mr. Krissinger's house.

It is claimed that these openings are on separate and distinct beds, which is possibly the true state of the case, although the question is one fairly open to doubt. The barometer gave a difference of level between the mines of about 40 feet, but the outcrops are separated by a tolerably wide horizontal in-

terval and could not be satisfactorily traced from the one point to the other.

The measurements of the two beds certainly bear a strong resemblance to one another, though the so-called "8-foot," or lower coal seems of somewhat inferior quality to that above.

The so-called "lower bed" measures as follows on Mr. D. Altfather's land:

Slate, gray.			
Coal	0′	8″	
Slate	0′	8″	
Coal	0′	6″	
Slate	0′	1″	
Coal	3′	9″	8′ 2″
Slate	0′	2″	
Coal, bony	1′	2″	
Slate	0′	2″	
Coal, bony	1′	0″	
Slate		?	

A measurement in the other mine on the same farm gave the following figures:

Slate, black.			
Coal	1′	3″	
Slate	0′	1″	
Coal	0′	9″	4′ 11″
Slate	0′	1″	
Coal	2′	9″	
Slate in floor.			

This is as much as was seen of the bed at this place, but Mr. Altfather claims to have dug through the lowest slate at one point in the mine, and continues the section in this wise:

Slate	0′	8″	
Coal	0′	6″+	1′ 2″
Cement (?)		?	

Including the lowest coal-bench (which should not be taken out in mining,) this bench would then have a total thickness of 6 feet 1 inch, 10 inches of which are slate, whereas in the other case, the bed was seen to be 8′ 2″ thick, including 13 inches of slate.

J. Altfather Mine.—Continuing south-westward as far as the old Schrack farm, an exposure of the "upper bed" is again seen, being here mined by Mr. J. Altfather.

The mine is some distance from Buffalo creek, and the coal is near its final eastern crop; it starts in, therefore, near the top

of the hill, but the excellent slate roof protects the bed from water, the coal showing to decided advantage. The mine is in good condtiion, the output from it being much larger than from any other drift in the vicinity.

A section of the bed is subjoined for comparison. It reads:

Black slate roof.		
Coal	0′ 11″	
Slate	0′ 1″	
Coal	0′ 8″	4′ 2½″
Slate	0′ 1½″	
Coal, including 0′ 2″ bony coal at top	2′ 6″	
Fire-clay slate	?	

The angle of the dip, as ascertained in the mine, is here as much as 8° to the north-west, and at one point even 10°. This is unusually steep, and does not prevail very far, or these rocks would soon be buried beneath a vast pile of measures. A sharp plunge, however, occurs at J. Altfather's mine, for in a distance of 100 yards the coal descends nearly 40 feet to the bed of a small run, where it shows precisely the same section as that given above.

About 25 feet above this last coal a still higher seam is claimed to have been found. It was once opened a short distance further down the run, and is said to have there measured nearly 4 feet thick. The openings are now shut, and the coal could not be seen.

The 25 foot interval is made up of black slates and shales in which are found nodules of carbonate iron ore, which latter does not, however, here occur in sufficient quantities to render the deposit of value.

A great lack of limestone occurs in the immediate vicinity of Engle's mill, and it is believed that the measures developed along the eastern bank of the creek are near the base of the Lower Productive group, which would explain the absence of the rock so much desired.

This was not fully established, but the facts point in that direction.

Limestone has been sought in the high land on the Krissinger farm, south of the mill, but thus far without success. This, however, is thought to be the likeliest place for it to occur in this neighborhood.

A small band of limestone has been opened in the bed of the creek, close to the mill.

Hay's Mills.

The little village of Hays' Mills, situated on the Allegheny Mountain branch of Blue Lick creek, is about five and one-half miles on an air line, south-west of the developments just described.

No coal is now mined in the vicinity of the Mills, and few openings, of either coal or limestone, have ever been made there.

But two beds of coal, separated by about 70 feet of measures, outcrop a short distance north-east of the village, and these beds are thought to belong to the higher strata of the Lower Productive system.

Mahoning Sandstone; Beds D' and E'.

A massive sandstone breaking up into blocks, covers the surface just above the outcrop of the higher coal bed. This seems to be the Mahoning Sandrock; and the coals outcropping would then constitute the two upper members of the Freeport group, which is further substantiated by the presence of a limestone band, 3 feet thick in one continuous bench, occurring at an interval of 18 inches below the lower coal.

A rich and abundant outcrop is all that is here known of the higher coal seam.

West and north-west of Hays' Mills the country is made up of Barren Measures, the Countryman farm (eastern outcrop of the Berlin group) being about one mile north-west of the Mills. To the east rises the Allegheny Mountain, the flank of which presents the same features as in the Engle's mill region.

Negro Mountain Mines.

On the top of Negro Mountain, (or the Ridge, as it is here called,) several miles west of Berlin, Mr. David Cover mines a bed of coal belonging to the Lower Productive group.

Cover Mine.—The mine is near the centre of the anticlinal, and the bed worked does not seem to cross the arch under cover. The rocks dip gently south-east.

The bed measures as follows in the mine:

Black slate.			
Coal	2′	3″	3′ 5″
Parting	0′	2″	
Coal	0′	2″	
Slate	0′	1″	
Coal	0	9″	
Slate		?	
Coal, reported.			

This mine is so isolated from all other openings and developments, that a determination of the bed here worked is thus rendered difficult. It is believed, however, to be the same as that mined by Mr. Isaac Hugus, near the town of Somerset, further west.

At the town of Garrett, on the Castleman river, the entire Lower Productive coal group is above water level, but only Beds D and D′ have been opened up.

The Pottsville Conglomerate rising north-westward appears in the gap of Negro Mountain just west of Garrett. Huge boulders of this massive sandrock are observed in the channel of the river, which is also bordered at times by vertical cliffs of the same rock.

Ascending the hill rising northward from the Castleman, a thin but persistent bed of coal, regularly underlaid by a band of impure fire-clay, occurs at the level of the railroad.

The exposure is a few miles west of the station, in a cutting through the point of a high bench composed of the following rocks:

Sandstone, broken	from 15′ 0″	to 18′ 0″
Coal		0′ 6″
Fire-clay	from 3′ 0″	to 5′ 0″
Sandstone, broken		15′ 0″
Shales with ore		5′ 0″
Interval to river, Conglomerate boulders		50′ 0″
Total		93 6″

Freeport Coals.

In the interval between this coal exposure and the outcrop of the Lower Freeport bed, far up on the hill to the north-east, no exposures of any kind are met with, but strata of coal doubtless intervene. Continuing upwards, the hill is sufficiently high at this point to include all the coals of the Freeport group; but these seams speedily disappear in go-

ing north-westward, though the lowest coals reach almost to the top of the anticlinal.

Bed D, with its band of underlying ferriferous limestone, shows just above water level at the mouth of Buffalo creek. This is only a few hundred yards east of Garrett.

It here yields 6½ feet of indifferent coal. The seam is also divided into two benches by a persistent band of fire-clay slate, which in the Somerset and Johnstown-Confluence sub-basins to the west, becomes its most prominent and characteristic feature. Attention is, therefore, here especially called to the fact.

Hay's Mine.—A handsome exposure of the bed on the property of Mr. Philip Hay gave the following section:

Fig. 24.

Black slates and shales ..	.....	8′ 0″
Coal.....	.....	4′ 6″
Shale.....	.....	0′ 3½″
Coal.....	.....	1′ 9″
Shale.....	.....	0′ 6″
Limestone.....	.....	2′ 6″+
Shale.....	.....	?
Limestone.		
Total.....		17′ 6½″

A considerable amount of coal and limestone has been obtained for domestic consumption from this outcrop of the bed, but the supply is now mainly derived from other points.

The high hills, which here rise north and south from the Castleman, include the balance of the Freeport coals, besides a large amount of Barren Measure rocks.

Bed D′.—The Middle Freeport coal shows in a side cutting on the railroad, at the point where the track crosses Buffalo creek.

Bed E.—Little is known respecting the Upper Freeport bed, which seems to be small and unimportant.

Bed D, North-east of Garrett.

The best known outcrop of the Lower Freeport Coal bed in this locality is that to the north-east of Garrett, on the so-called

"Garret tract," overlooking the town. Where opened up on this tract the bed is 175 feet (by barometer) above the railroad at the station. This will convey some idea of the comparatively rapid rise of the rocks towards Negro Mountain, the mine on the Garret tract being one mile north (and therefore not with the full force of the rise) of the opening on Mr. P. Hay's property.

Only one bench of the bed was mined on the Garret tract, and this bench shows precisely the same section as already given in connection with the developments made by Mr. Hay.

The limestone was also quarried on the Garrett tract, and though carrying a large amount of iron and clay, produced a lime well adapted for fertilizing purposes.

Following the outcrop line of the Lower Freeport seam north-eastward around the hill, exposures of the coal occur at several points within short distances of each other. These, however, are only partial openings and do not show the full height of the bed. But they show very plainly that the main or upper bench maintains an uniform thickness, and is the same generally, for a distance of at least one mile.

H. Walker Mine—Thus, in Mr. Hiram Walker's mine, near the point where the outcrop of the bed crosses Buffalo creek, the following section was obtained:

Slate.		
Coal	1′ 6″	
Bony coal	0′ 3″	4′ 3″
Coal	From 2′ 3″ to 2′ 6″	
Fire-clay shale in floor.		

The coal carries both sulphur and earthy matter in abundance; it mines out in blocks, and would bear transportation.

The mine was started with the intention of shipping coal from it to market.

Wigle Mine.—This coal bed goes under water level on the adjoining property of Mr. Jas. Wigle, of Berlin, who once opened it a few feet above the level of the creek, and found full 6 feet of coal, underlaid by limestone, which, however, is too close to the creek to admit of being quarried at this place without interference from the water. Specimens of the limestone showed it to be highly ferriferous, and corresponding with that seen on Mr. Hay's land, near Garrett.

The "6-foot" coal bed is no longer mined on Mr. Wigle's land, the next bed above (Middle Freeport) monopolizing attention; but specimens of the Lower Freeport coal were obtained on this property and forwarded to Harrisburg for analysis, where they yielded as follows (D. M'Creath.):

"Water	.850
Volatile matter	16.850
Fixed carbon	69.578
Sulphur	2.587
Ash	10.135
	100.000

Coke per cent, 82.300; color of ash, gray.

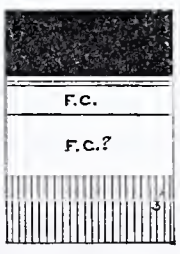
The coal is very tender, and is seamed with slate, charcoal and iron pyrites."

This analysis is not flattering to the coal, but possibly the specimen analysed may not represent the average run of the bed; though the specimen was selected with considerable care by Mr. Wigle, who is thoroughly familiar with the coal beds here above water level, and their average condition.

Bed D'.—The outcrop of the Middle Freeport bed, about 40 feet (by barometer) above the one last described, follows round the hill from the opening on the "Garrett tract" to that on Mr. Wigle's land, where it is at present quite extensively developed by the Garrett Coal Company.

On the Garrett tract it is claimed to have shown from 32 to 36 inches of coal in one solid bench, which seems to be about the average thickness of the bed. But this opening is now closed, and the bed can be examined only on Mr. Wigle's land, where it shows this section:

Fig. 25.



Black slate.			
Coal		2′	10″
Slate		0′	2½″
Coal		0′	1½″
Fire clay, impure (seen).		1′	3″
Fire clay, additional	Reported by Mr. Wigle.	2′	9″
Limestone, good		3′	0′
	Total	10′	2″

Despite the disadvantages attendant upon the working of so small a seam, the coal is successfully mined and shipped to

market, coming into competition even with the famous steam coal from the Pittsburg bed of the Salisbury basin. A small portion of the bed is compact and slaty, and from the analysis given below it would appear that the specimen forwarded by Mr. Wigle to Harrisburg was taken from that part of the seam.

The analysis, by Mr. D. M'Creath, is as follows:

"Water at 225°.....	1.020
Volatile matter.....	17.135
Fixed carbon.....	66.679
Sulphur.....	.676
Ash.....	14·490
	100.000

Coke per cent, 81.845; color of ash, gray.

The coal is compact, seamed with charcoal, and shows a few scales of iron pyrites."

Bed E and the Mahoning Sandstone.

At this mine the hill to the east rises scarcely high enough to include the next higher coal seam. But a short distance beyond, to the north-east it gains somewhat in height, and the surface is covered with boulders of heavy sandrock, which also is found occurring in place. This clearly represents the Mahoning sandstone.

On the opposite side of the creek the hills rise much higher, and begin to take in the Barren Measures on their tops. These rocks descend south-eastward towards the centre of the basin, and on the southern bank of the Castleman river the entire series, 550 feet thick, gets under cover, thus permitting the Pittsburg coal bed to appear in the high country to the south-west of Meyersdale.

CHAPTER V.

The Salisbury Sub-Basin in Somerset County.

The Salisbury coal basin is the region bounded on the north by the Castleman river, on the east by the Allegheny Mountain, on the south by the Maryland State line, and on the west by Negro Mountain.

The width of the basin from the crest of the Allegheny to the crest of Negro Mountain is about 7½ miles; the *length* from the Maryland line to the Castleman river at Meyersdale is about 9 miles.

Topography of the Basin.

The Castleman river, coming in from Maryland, runs along the foot of the Allegheny Mountain, keeping usually about an even distance from it, for 9 miles to Meyersdale; at that point it turns sharply to the west, and keeps to the west and southwest, cutting through Negro Mountain and gapping it to the base.

Elk Lick creek, rising in Pennsylvania, about at the State line, on the crest of Negro Mountain, enters the Castleman only one-half a mile west of Meyersdale.

Between the Castleman river and Elk Lick creek there is a high plateau, very regular and level on top, the summit being 350 to 400 feet above the enclosing waters, and averaging about *eight* miles long by *two* miles wide. This plateau is deeply gashed by the broad ravines of the small streams which head up chiefly on the west side of the plateau and cut across it, emptying their waters into the Castleman river.

The topographical map accompanying this report (Plate XVII) shows this plateau, and also the Castleman river and Elk Lick creek. The levels are put upon it in 10 foot contours, and the outcrop of the Great Pittsburg Coal Bed is

plainly drawn. The general structure, which is extremely simple, and the rocks which occupy the different parts of the basin, are shown on the eross seetions on the map.

Geological Structure of the Basin.

The Pottsville (Seral) Conglomerate, XII, makes the crest of the Allegheny mountain, plunges under the Salisbury Basin, and reappears on the surfaee as the erest of Negro Mountain. The Salisbury eross section (Page Plate IV, Fig. 26,)shows the strueture so clearly as to render unnecessary any detailed description.

The Lower Productive Coal Measures, here about 300 feet thiek, eome in directly on top of the Seral Conglomerate. They dip down with it into and under the Salisbury Basin. Their outcrops are only found therefore on the foothills of the Allegheny and Negro Mountains.

The Lower Barren Measures, 550 feet thiek in this region, with the Mahoning sandstone as their bottom rock, eome in on top of the Lower Productive series. These measures, occupy the parts of the basin which lie directly east of the Castleman and west of Elk Liek creek; the upper part of the Barren Measures making the rocks exposed on the Castleman and Elk Lick creek, but the greater part of the group passing under the central plateau below water level.

The Upper Productive Coal Measures come in on top of the Lower Barren Measure group, holding in them the Pittsburg Coal Bed and Limestone with the smaller coals of the upper group. It is the presence of the *Pittsburg Coal Bed* which gives this small basin such an exceptional value and importance. This bed, which is the gas coal bed at Irwin's Station, on the Pennsylvania Railroad, the Connellsville coking coal bed, and the gas coal bed of the Youghiogheny and Monongahela rivers, is found almost exclusively west of the Chestnut Ridge or Second Great Antielinal Axis. The exceptions to this rule are the small patch in the Ligonier valley, south of New Florence, this Salisbury Basin, the Cumberland (Maryland) Basin, and a small knob in the Broad Top region. From all of the broad area stretching from the Chestnut Ridge to the Cumberland and Broad Top basins, over the whole of which the Pittsburg Coal at one time extended in an unbroken

sheet, the bed has been torn away, leaving only the small areas above named.

The basin in which it is held in the Salisbury region, bounded on the east by the Castleman river, and on the west by Elk Lick creek, is a *true canoe-shaped synclinal basin.* It rises on the sides, to the south-east to the Allegheny, and to the north-west to the Negro Mountain anticlinal; but it also points up to the north-east and south-west from the centre of the synclinal. This rise to the north-east, which is very slight in the centre of the basin, becomes decided on approaching the north end, and is there sufficiently strong to carry the Pittsburg coal bed over the hilltop at Meyersdale. In the same way the basin rises to the south-west from its centre, slowly at first, gradually increasing the rapidity of the rise, and finally shooting the Pittsburg coal bed out of the hilltops at the Miller and Beachy mines on the Maryland State line.

The rising to the southward, which is very decided from Tubmill run on to the Maryland State line, at once effects the practical value of the basin. In the northern part and in the centre, where there is great horizontality, the upper limestone, 160 feet above the Pittsburg coal bed, everywhere crowns the hill-tops and can be opened on the crest of nearly all of them. The effect of the rising of the rocks is to throw this limestone out of all the hills south of Grassy run.

The country level remains about the same, or is slightly higher to the south-west; but the Pittsburg bed, which was from 160 to 200 feet below the hill-top at the north end of the basin, at the south end has scarcely cover enough to keep it in good order.

Just as the Upper limestone is thrown out of all hills south of Grassy run, the Middle limestone, 90 feet above the Pittsburg coal bed, catches the first hill-top south of Tubmill run, and after that point is thrown out of the hills to the south-westward.

And the same gradual rise, as already stated, throws the Pittsburg coal out to its final outcrop near the Maryland line.

As will be seen from the detailed report of the measures developed in the basin, there is a remarkable and bewildering resemblance of the different limestones to one another.

Of the *limestones of the Pittsburg Group* there are—

1. A *limestone* 160 feet above the Pittsburg Coal; it is 10 feet thick, and has a small coal overlying it.

2. A *limestone* 90 feet above the Pittsburg Coal. It is 8 to 10 feet thick, and has a small coal overlying it.

3. A *limestone* which shows at the south end of the basin, 30 feet above the Pittsburg Coal; it is 8 feet thick, and has a small coal overlying.

There is a difference observable in these limestones, in their bedding, color, &c.; but the differences are very slight and not sufficient alone to make an identification without reference to a fixed and recognizable horizon, such as is afforded by the Pittsburg Coal Bed.

The result has been that much uncertainty and error have prevailed as to the measures in the basin; and an unduly large amount of coal has been supposed to exist in the region, the confusion concerning the limestones having caused a doubling up of the Pittsburg Bed.

This point should be set at rest. *There is one,* and only one, large 10-foot coal bed in the central plateau of the basin, and this is the Pittsburg Coal Bed.

It has been asserted, and receives much credence in the region, that the large coal bed opened up on Negro Mountain is the same as the Pittsburg bed of the centre of the basin. This point also should be set at rest. It is a different coal bed, belonging to the Lower Productive Measures, while the Pittsburg bed is in the Upper Productive measures; the Negro Mountain Coal bed underlies the Pittsburg bed by several hundred feet, and is far below water level in the centre of the basin.

The general topography of the basin shows the geology very clearly. Where the Lower Productive Coal Measures are the country rock, on the flank and foot hills of the Allegheny and Negro Mountains, the surface is rugged, stony and uncultivated.

The Lower Barren Measure part of the basin shows softly rounded hills and a deep, though rather clayey soil.

The central ridge of the basin, of Upper Productive Coal Measures, is smooth, with gentle slopes down to the streams. The soil is good and the abundance of limestone and coal so

easily and cheaply accessible secures well enriched and valuable farms. The whole upland of the centre of the basin is under successful cultivation.

MEASURES IN THE BASIN.

The detailed description of the different coals, limestones and iron ores of the Salisbury Basin is given below.

The vertical sections shown on Plates VI and VII give in detail the coal beds and interval rocks in a height of nearly 600 feet, that is, from a small coal which lies 385 feet below the Pittsburg Coal Bed to the hill top on the central plateau, 200 feet above the Pittsburg Bed.

The measures represented in the basin are—

III. The Pittsburg, or Upper Productive Group, of which only 200 feet are exposed.

II. The Lower Barren Measures, 550± feet thick.

I. The Lower Productive Group, 300± feet thick.

Lower Productive Coal Group.

The openings and exposures in the Lower Productive group in the basin are very scanty in number. Occupying, as these measures do, only the sides of the basin, and consequently the foot hills of the mountains, they are but little developed, and the regions where they outcrop are rough and heavily wooded.

Such specific measurements as could be made are given below under the proper heading.

This Lower Productive Coal group has already been described in full in chapters 1 to 3 of this volume, with many complete vertical sections, showing the coals and interval rocks as they are exposed at numerous points to the north-east of the Salisbury mines and in the same sub-basin. A reference to that description renders it unnecessary to again describe at length the general geology of the group.

Lower Barren Measures.

The Lower Barren Measure group is found in the Salisbury basin about 550 feet thick, this being the interval between the Pittsburg Coal Bed and the Mahoning Sandstone. There are no opportunities for getting the exact measurement of the total thickness of the rocks at any one place; but with all the allowances for dip and necessary estimates, the total of 550 feet is undoubtedly a close approximation to the truth.

In the previous chapter on the Berlin region three hundred feet of this group have been fully described; this description embracing that part of the group which starts 200 feet below the Pittsburg Coal Bed, and extends down to an horizon 500 feet below the Pittsburg Coal Bed.

No such favorable opportunity is found in the Salisbury Basin. The Barren Measure Coal Beds, which at Berlin, and for several miles south-west of it, are good workable coal beds, are found in the Salisbury region usually as small and entirely worthless beds, whenever indeed they can be found at all.

The measures overlying the Mahoning Sandstone for 350 to 400 feet are the rocks already fully described in Chapter III.

Elk Lick (Upper Berlin) Limestone.

This brings us to the Elk Lick (Upper Berlin) Limestone, which is identified as the same as the one opened by E. Yoder on Elk Lick creek and at numerous other points in the basin. It lies 210 to 220 feet below the Pittsburg Coal Bed. Only some six feet of limestone were seen at the openings examined, but it is reported as having been repeatedly quarried fully twelve feet thick.

Elk Lick Coal Bed.

Over it lies a bed of coal now nowhere opened for measurement, but worked in several places in the basin in past years. It is called a "four foot bed" of "a good quality of coal."

This bed was named the "Elk Lick Coal Bed" by Prof. Lesley in 1840, it being then opened on Elk Lick creek. Much confusion has arisen as to the geological position of the coal. The distance below the Pittsburg Coal Bed was correctly given as 200 feet; but at the same time the bed was placed just over the Mahoning Sandstone, the Lower Barren Measure group being given only 250 feet of thickness here, instead of say 550 feet, as is really the case.

The horizon of the bed has always been calculated from the Mahoning Sandstone on the above erroneous data, and endless troubles have resulted from the attempts at identification. The "Elk Lick Coal," is a bed which lies only 200 feet below the Pittsburg Coal Bed, and 350 feet above the Mahoning Sand-

stone; and which in the Salisbury basin on Elk Lick creek is a workable coal.*

Morgantown Sandstone.

On top of this coal there comes in a massive gray sandstone ranging from 50 to 60 feet in thickness. This is probably the representation of Prof. Stevenson's *Morgantown Sandstone* horizon.

Little Pittsburg Limestone and Coal.

Shales and slates, with thin sandstones, holding small and uncertain ball iron ore layers, with one regular and persistent coal one foot thick, 80 feet below the Pittsburg Coal Bed, are the interval rocks overlying the Morgantown Sandstone until the Little Pittsburg Limestone and coal are found 50 feet below the Pittsburg Coal Bed.

The limestone is about 5 feet thick, and is quarried in several places.

The coal is small and worthless, and has never been worked at all, except at one place near the north end of the basin where it was mined to a small extent many years ago. It was there also small and poor.

Shales and slates, with one small coal crop at 25 to 30 feet above the Little Pittsburg Bed, make up the 50 feet of measures between the Little Pittsburg and the Pittsburg Coal Bed.

Upper Productive Coal Measures.

Of the Upper Productive Coal Measures the deepest point of the basin only shows 200 feet in all, that is from the floor of the Pittsburg Coal Bed to a sandstone 50 feet above the Great Pittsburg Limestone.

Pittsburg Coal Bed.

This great bed keeps in the basin some of the distinguishing features which mark it at the numerous other places where it is worked.

It varies somewhat in size, character, and in its partings; but is always a large workable bed, yielding good coal.

*It is erroneously called the Barton Coal in some vertical sections in Reports K and L, 1875.

In the northern end of the basin the slate partings are much larger and more persistent; but in the middle and southern part of the basin the coal bed shows in a solid mass, averaging ten feet thick, and with no persistent parting except the regular bearing in slate about 18 inches above the floor.

The floor is sometimes sandstone and sometimes clay; the roof is in every case tough black slate, with black slates and shales overlying for from 15 to 20 feet.

The (Pittsburg) Rider Coal.

In the southern, and southern middle parts of the basin, the Pittsburg coal bed carries a rider coal in its overlying black slates. This rider varies widely in its distance from the top of the bed, being only 4 feet distant at the south end of the basin, 12 feet at the middle of the basin, four miles away, and *totally wanting at the north end.* Such appearances and disappearances of small rider coals in the overlying black slates of a coal bed are not infrequent.

Cases showing just such rapid changing, and even disappearance of rider coals, have already been noted and described in the case of the Rider Coal and Bed B in Clearfield county.

Redstone Limestone.

At an opening on the old Miller farm, at the south end of the basin, M. J. Beachy has opened a limestone, the bottom layer of it being only 30 feet above the floor of the Pittsburg coal bed, and the top layer only 6 feet below the bottom of the Redstone coal bed.

This massive limestone, full 10 feet thick, is extensively quarried. It cannot be found, however, on the adjoining properties, but is said to have once been opened near the middle of the basin. Numerous exposures at different places show that it is wanting over nearly the whole basin. It is a regular and persistent deposit, however, at the same horizon, in the Second Great Basin, or Ligonier Valley, though usually lacking in Southwestern Pennsylvania.

Redstone Coal Bed.

At a regular distance of 45 feet above the Pittsburg coal bed, there is found a persistent, though small coal bed, which may hereafter be identified with the Redstone coal bed. It is nowhere

worked, but has at times been opened sufficiently to show that it occasionally reaches a thickness of 4 feet of coal; but to judge from its outcrop, it would not maintain anything like this average size throughout the basin.

Middle (Sewickley) Limestone and Coal.

At a distance of 85 to 90 feet above the Pittsburg coal bed a massive limestone, 8 to 10 feet thick, is found all through the basin, keeping its interval distance with great regularity. It is opened in many places, and is always a large bed and of good character.

On top of it there are some 15 to 20 feet of black slates, holding in them two small coal beds. They are too thin to be of any practical value. They represent, probably, the Sewickley coal bed.

Upper Limestone and Uniontown Coal.

At a regular distance of 155 feet above the Pittsburg coal bed the Upper or Great Limestone is found, 10 to 12 feet thick, in massive layers. It only occurs in the middle and northern parts of the basin, the hills in the southern part not being high enough to take it in.

On top of it a parted coal bed comes in, usually slaty and worthless. This represents the Uniontown coal bed.

Sandstone overlies the coal, and extends to the hilltops.

It is not necessary here to institute any special comparisons of the Upper Productive Group in the Salisbury basin with the measurements of the same group as found in the southern corner of Pennsylvania. These measures have already been fully figured and described in Report K for 1875 of the Second Geological Survey. The reader is therefore referred to that volume, p. 64 *et seq.* for complete figures of vertical sections, with descriptions and comparisons.

To show how closely the measures immediately overlying the Pittsburg Coal Bed, as well as those underlying it, as exhibited in the Salisbury Basin, are found to agree with the same measures in the Second Great Basin, west of Laurel Hill, the following compiled section, made in the Ligonier Valley, in Fayette county, south of the Conemaugh river, is reproduced from the Final Report of 1858*:

* Rogers' Final Report, Vol. II, p. 662.

Highest land, in the centre of the *Ligonier Valley.*		
Sewickley Coal (?) bench	—	—
Interval	10′	0″
Sewickley Limestone, tolerably good ..... 7′ to	8′	0″
Sandstone, fine bedded, Concealed measures,	35′	0″
Redstone Coal [called wrongly Sewickley]	3′	0″
Interval	5′	0″ (?)
Redstone Limestone, good hard and blue	8′	0″
(This is 6 feet at Kieffer's, and elsewhere 4 feet.)		
Shales and black slate	10′	0″
Rider (?) Coal [called here wrongly Redstone]	3′	0″
Shales, brown and black slate	20′	0″
PITTSBURG COAL BED	8′	6′
(At Kieffer's, 10 feet; at Greig's, 7 feet.)		
Interval	20′	0″
Pittsburg Limestone, white, flaggy, good.... 4′ 0′ to	9′	0′
Flaggy sandstone	20′	0″
Coal, good	3′	0″
Interval	8′	0″
Limestone, ferruginous	3′	0″
Shales, olive and black	15′	0″ (?)
Coal, only the outcrop visible.		
MORGANTOWN SANDSTONE [called here wrongly Mahoning]	50′	0″
Olive shales	24′	0″
Black slate	6′	0″
Coal crop.		
Interval	15′	0″
Coal (?), outcrop.		
Olive ferriferous shale	30′	0″+
Elk Lick Coal [called wrongly Freeport]	1′	0″
Elk Lick Limestone [called wrongly Freeport]	1′	0″
Total	315′	6″

The identifications of the lower part of this section, from the "Mahoning Sandstone" downwards, were made on the erroneous supposition that the Lower Barren Measures were in this region only about 200 feet thick, and were therefore entirely incorrect.

The lowest limestone of this section is the Elk Lick limestone, which in the Salisbury basin is 210 feet below the Pittsburg Coal Bed; in the Ligonier Valley just 204 feet below the Pittsburg Coal.

The Elk Lick Coal, resting directly upon it, is found in place in the Second Basin; though smaller than at Salisbury.

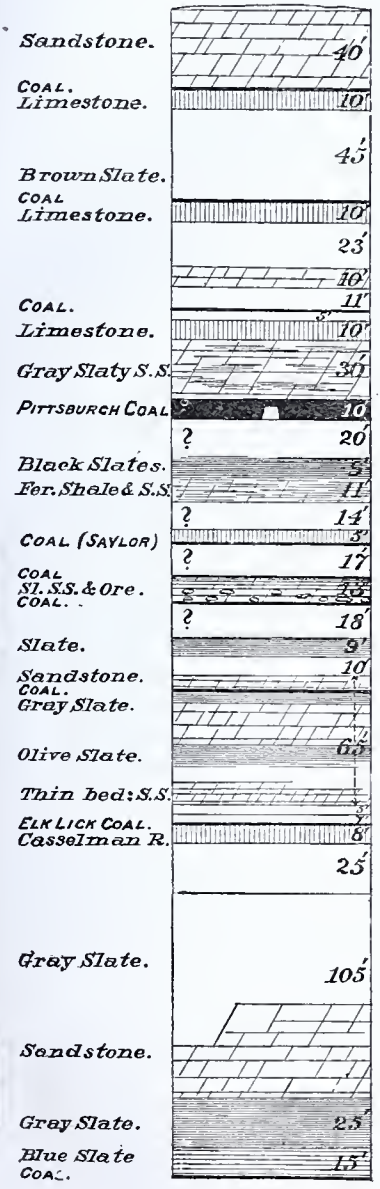
The most striking feature of the section, however, and the one to which special attention is called, is the presence in it of

SECOND GEOLOGICAL SURVEY OF PA.

Comparison of the Coal Measures at

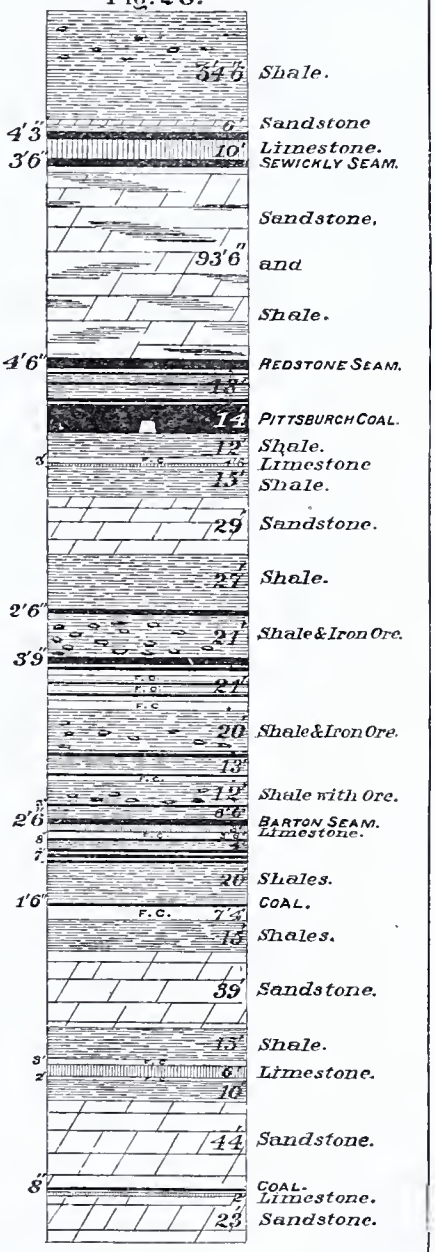
Salisbury, Somerset Co. Pa. (by R. & W. G. Platt.)

Fig. 27.



Piedmont, Allegheny Co. Md. (by H. G. Jones, 1874.)

Fig. 28.



O. B. H.

a limestone, 33 feet above the Pittsburg Coal Bed. The existence of a limestone in this rather unusual position has caused much confusion in the Salisbury Basin, as already stated; it is found, according to the Final Report of 1858, as a persistent deposit in the Second Basin.

The other measures, both above and below the Pittsburg Coal Bed, agree closely with the Salisbury Basin sections.

LOWER PRODUCTIVE COALS IN THE SALISBURY BASIN.

It has been shown in the description of the general geology of the basin that the Lower Productive Coal Measures make up the west slope of the Allegheny Mountain and the east slope of Negro Mountain, passing under the centre of the basin, far below water level. The Lower Coal System is seen cropping out through the hill country to the east of Salisbury, and on the sides of Piney Run.

But the coals are entirely undeveloped. The settlements in the valley of the Castleman river or the Elk Lick creek, are so close to the mines on the Pittsburg Coal Bed in the central plateau of the basin, and can procure so cheaply from that great bed their supply of excellent coal, that the lower coals are necessarily neglected.

The system and nomenclature of the lower coals in this first basin, farther to the north-east, have already been given in previous chapters.

Lower Coals on the Allegheny Mountain.

In an examination made several years ago the following facts were developed with reference to these lower coals:*

"A coal bed is opened on the Grandman Tract, (1½ miles east of Salisbury,) at an elevation of 252 feet above the Salisbury bridge level and 269 feet above the bed of Piney creek at this point, which is a mile, more or less, above its mouth. Its roof is a shale stratum, 8 feet thick, capped by a 9-inch plate of sand-rock, over which are shales. The dip of the sand-rock stratum is 10° towards the north 30° west, which would bring this coal down 800 or 900 feet in a mile; but the dip diminishes as the centre of the basin is approached.

* Report of J. P. Lesley, 1870.

"In a drift on the Engle property, (lying between the Grandman and Boyd tracts,) this bed is 77 feet lower down the hillside, the dip being here only 6° to the north 30° west.

"Another coal outcrop on the Grandman tract, is at an elevation of 448 feet, (above Salisbury bridge,) and spreads over a large space on a sloping terrace—thickness of bed unknown. An outcrop of sandy brown hematite iron ore is seen 100 yards to the south-east of this coal crop, and at an elevation of 500 feet.

"The outcrop of a small coal bed "2 feet thick" is seen 100 yards south-west of the abandoned Grandman drift (252 feet) above mentioned. It rests on a bed of poor iron ore, in the shape of masses of yellow hematite, enclosing nodules of wet, yellow clay. The ore rests on an unknown thickness of impure *limestone.*

"In the steep north bank of Piney creek, two-thirds of a mile above its mouth, on the Boyd tract, 7 feet above the level of the water in the creek, is the crop of a one foot coal bed under a mass of 15 to 20 feet of slaty shales, containing quantities of poor clay iron ore, and capped by a calcareous fire clay. This little coal bed lies upon a bed of *limestone* at least 6 feet thick.

"Probably these two exposures of limestone are one bed, and the two coals are the same, and the iron ores are a regular stratum, which may be valuable along the long outcrop at some points.

"Fifty yards down the creek from the last mentioned exposure of coal and limestone, in the same steep hillside, may be noticed another exposure of this coal, here very bony and bad, 17 inches thick, and wedged in between 4 feet (and more) of *limestone* underneath, and 11 feet of an overlying hard, granular sandrock, without any sign of iron ore.

"About one-third of a mile up Piney creek above its mouth, on the Boyd tract, is an exposure of fire-clay, said to be 8 feet thick."

Oil Well Record.

A boring for oil was made in this basin to a depth of 678 feet, passing through three coal beds at depths of 96, 136 and 266 feet from the surface. These represent three

of the Lower Productive Coals. The record is re-produced below; but it must be borne in mind that the ordinary oil well borer's record is almost useless in estimating the coal beds passed through. The roof slates, the coal, and all its partings, are grouped together in one measurement, and the thickness of coal is almost always so overestimated as to fail entirely as a measurement. But it serves to show the horizon of the coals. The accuracy of the copy of the record is guaranteed by Joel Miller, Esq., President of the Company.

Oil Well Record.

Coal, at	96′
Coal, at	136′
Coal, at	266′
Black slate, with streaks of *coal*, 2 feet, at	320
Two layers of slate, and iron ore above both	350′
Iron ore balls, at	375′
Sandstone	from 375′ to 400′
Sandstone 20 feet thick, some shale layers, at	420′
Sandstone, 40 feet thick, at	440′
Brown slates and streaks of *coal*, at	480′
Sandstone, 60 feet thick, very hard with brown shale and slate at bottom, at	500′
Soapstone, at	560′
Grey shale, at	590′
Shale, at	605′
White Sandrock, at	620′
Red shale, at	640′
Gray shale and thin sandstone to bottom, at	678′

On the flank of the Allegheny Mountain, from Piney run north-eastward to Flaugherty's run, (which comes into the Castleman river at Meyersdale,) there are no developments on the Lower Productive Coal System.

Lower Coals on Tubmill and Elk Lick Runs.

Proceeding west and north-west from Salisbury, up the valley of Tubmill run, the basset edges of the outcropping Lower Barren Measures are crossed for a considerable distance after leaving the developments on the Pittsburg Coal Bed near the mouth of the run. These Barren Measures extend in fact nearly to the forks of Tubmill run, full three miles north-westward of the mouth of the run on the Castleman river.

The junction of these two small forks, both of which head on the top of Negro Mountain, occurs in a region which seems to be made up of rocks belonging to the Lower Productive

Coal System. Higher up on the Negro Mountain, as is described further on, the Lower Productive coals may be seen rising to the surface and outcropping before reaching the centre of the Negro Mountain anticlinal axis. Moreover, they are regularly underlaid by the Pottsville Conglomerate, which is at this place a heavy massive deposit, forming cliffs along the summit of the western flank of the mountain. The eastern slope of Negro Mountain therefore continues coal bearing, south-west of the Castleman river, certainly as far as the Maryland line. But exactly how much of the Lower Productive Coal Measures are either above or below water level at the junction of the North and South forks of Tubmill run, must remain for the present undecided. Scarcely any research whatever has thus far been made in this vicinity for coal or iron ore. A low hill, beautifully benched, shows on Mr. Cristner's land, a short distance north-east of the saw mill. These benches still remain unexplored, although it is claimed that a "3 foot coal bed" exists near the top of the hill.

Very little is known respecting the band of carbonate iron ore which is reported to have been found in laying the foundation of the saw mill near the point of junction of the North and South Forks of Tubmill. The ore band is represented as 13 inches in thickness; the ore is smooth and compact, and is apparently rich in iron; it is overlaid by tough black slate.

Further down the run (one-fourth of a mile distant from the mill) a band of limestone has been found twenty feet above the bed of the stream. This limestone is 15 inches thick; it is impure, carrying much iron; it is overlaid by sandy shales for six feet, and is underlaid by ferruginous clay for one foot, below which several feet of fire-clay are exposed.

J. N. Davis' Openings on Negro Mountain.

Ascending Negro Mountain from the sawmill, coal openings are found on the property of Mr. J. N. Davis, near the summit of the mountain. This is at the crop of the coals, preparatory to their crossing the anticlinal arch.

The developments made by Mr. Davis were on a coal bed claimed by him to be seven feet thick, without persistent slate partings. A number of test openings are said to have been made, and the thickness of the bed thereby determined. All

of these pits are now entirely closed up. So far as could be determined, this is the second coal bed above the Pottsville (Seral) XII Conglomerate, the first, or lowest, coal bed coming to daylight near the old stable, some distance west of Mr. Davis' openings. This is a marked outcrop, with a coal bench over it, out of which issues a spring of sulphurous iron water. The bench was traceable along the crest of the mountain for some distance.

Behind this the Pottsville Conglomerate XII is soon seen in abrupt cliffs; the surface of the ground being almost destitute of vegetation, and covered with masses of sandstone and pebbly conglomerate.

The large coal bed claimed by Mr. Davis is provided with a very limited amount of cover along its final crop. Notwithstanding this, the bed could probably be advantageously mined for the supply of the local market afforded by the eastern portion of Addison township, where a great lack of coal prevails, the farmers in that region being at present obliged to draw their supply from near Salisbury.

After what has been said, it is perhaps needless to report that the large coal bed claimed on top of Negro Mountain is a totally distinct bed from the Big Bed of the Salisbury Basin. The latter, the Pittsburg coal bed of the Upper Productive Coal Series, overlies the former, or Davis bed of Negro Mountain, which is near the bottom of the Lower Productive Coal Series, by some 800 feet of interval rocks. Misapprehensions, however, were found to prevail in reference to the matter, and an additional statement is perhaps rendered necessary to avoid further errors.

Elk Lick Falls.

Close to these developments are the head springs of Elk Lick creek, of the north fork of Tubmill run, flowing eastward, and also of Zook's sawmill run, which descends the western slope of Negro Mountain. All these streams have their rise within a short distance of one another.

Descending Elk Lick creek to the Falls, the valley through which the stream flows is narrow, though deep. The country is wild, and the timber has not yet been cleared from the hill slopes. But the high land above is divided into farms and is

under cultivation. In the vicinity of the Falls, the developments already made seem to establish the presence of the Freeport group above water level. The openings, however, are not of a very satisfactory character.

Johnson's Coal Opening.—The lowest of these coals was seen on Mr. Daniel Johnson's land, about two-thirds of a mile north-north-east of the Falls. The coal exposed is only a few feet above the waters of a small run. The bed measures nearly five feet thick, and is parted near the base by a thin layer of clay. Beneath the lower bench a deposit of limestone is reported to have been at one time opened up. The coal has never been worked to any extent.

Bachus' Coal Opening.—On the opposite side of the hill a higher bed of coal shows on the D. Bachus place. This coal, likewise underlaid by limestone, is worked by Mr. Bachus; the limestone is also quarried and burned for fertilizing purposes. Above this a still higher coal bench was observed.

The measures here dip south-east and disappear quickly under the high Barren Measure hills to the eastward.

Iron Ore at the Falls.—At Elk Lick Falls (a well known locality in these parts) a valuable bed of carbonate iron ore is known to exist. The former openings on this deposit are now closed up, but it was seen many years ago by the Geologists of the First Geological Survey of Pennsylvania, and is thus described: *

"The most important deposit of iron ore hitherto brought to light in this basin is that of Elk Lick Falls, above referred to. There are here three layers of iron ore. The lowest, measuring 1 foot 4 inches, is a nearly solid bed, merely divided into blocks rounded at the edges. The other two overlie the first at a distance of 2 feet, and together contain as much ore as would be equivalent to a solid band about 4 inches thick. An ore, supposed to be the same band, was discovered two miles farther down the creek."

Tub Mill Run.—In speaking of the iron ores of Tubmill run, the Final Report says:*

"Several thin seams of ore likewise occur on Tubmill run, half a mile below the saw mill, but they are not of sufficient import-

* Rogers' Final Report, 1858, Vol. II, p. 651.

ance to attract attention. At another place, on the same stream, ore is said to have been opened in a position 25 feet below a coal seam 3 feet 3 inches thick, identified with that at the Falls. This ore is stated to amount to 15 inches."

At the Falls, Elk Lick creek has forced a narrow passage through a deposit of massive sandstone, the outcrop of which lines the creek for some distance with vertical walls of rock. If the above identification of the coals seen in this vicinity be correct, this sandstone deposit must belong to the Freeport group of rocks, and is doubtless the Freeport sandstone.

Following the Elk Lick creek down towards Meyersdale, the rocks descend with greater rapidity than the creek, and the Lower Productive Coal Measures soon give place to higher strata, the Lower Barren Measures first coming in on top of them, and the Upper Productive Coal Measures, holding the Pittsburg coal, coming in finally on top of all, and making the country rock of the central plateau of the basin.

There are numerous gorges in the sides of the Allegheny, Negro Mountain, Laurel Hill and Chestnut Ridge, which present rarely beautiful pictures of rugged scenery; but there are few which compare in natural beauty to the head waters of Elk Lick creek.

Prof. Lesley thus described it many years ago. (See Fifth Annual Report of Prof. Rogers; 1841, page 82.):

"The falls of Elk Lick are a succession of many small and rapid leaps, winding in a long descent through a narrow irregular channel in the sandstone; the rocky walls sometimes overhang the stream, which is then darkened by the meeting boughs of the trees and the tangled stems of the laurel, which in many places make an almost impenetrable thicket. The defile itself is alternately contracted into short narrow passages, and widened into more spacious chambers. The whole scene, though of limited extent, is striking for its novel and picturesque beauty, and in perfect keeping with the wilderness around."

LOWER BARREN MEASURES.

The Lower Barren Measures, from the Mahoning sandstone up, for a distance of 350 to 400 feet, have already been fully described in Chap. III of this report

These measures show much less perfectly in the Salisbury basin. In the lower part of them the outcrops are much obscured by the great mass of debris which covers the hill sides, from the rapid disintegration of the soft shales and slates. The railroad cuts afford only imperfect exposures.

At a distance of 385 feet below the Pittsburg coal bed a small coal bed, not more than 2 feet thick, is found in a mass of black slates, 30 feet of them in all. This bed is 160 feet below the Elk Lick limestone, and is easily identified with the same coal (the Price bed) where opened on the Blue Lick.

Elk Lick Limestone.

At 225 feet below the Pittsburg Coal Bed a regular and persistent limestone is found, and is opened and worked at numerous points of the basin. This limestone is identified as the Elk Lick Limestone already described.

E. Yoder's Quarry.—It is opened on Elk Lick creek, one mile above its mouth, on the north-west end of the basin, on the Elias Yoder place. It is found in the bed of a small stream which flows past Mr. Yoder's house and empties into Elk Lick creek at that point.

The limestone is worked only to a small extent, and affords an imperfect measurement. So far as seen it gives two layers separated by a thin but persistent parting of shale. The upper layer is two feet six inches thick, and when burned, yields an excellent lime. Only six inches of the top of the lower band have been exposed. The usual average thickness of the bed is not less than six feet. The lower bench is much more argillaceous. The weathered edges of the limestone exhibit many minute fossils.

A coal smut shows almost directly on top of the limestone; and ten feet above occurs a mass of black slate and shale containing numerous nodules of good looking carbonate iron ore.

A specimen of the Upper bench of Yoder's limestone was forwarded to the Laboratory of the Survey in Harrisburg, and gave on analysis: (D. M'Creath.)

Carbonate of lime	55.589
Carbonate of magnesia	14.225
Carbonate of iron	6.835
Alumina	2.886

Sulphur	.185
Phosphorus	.032
Carbonaceous matters	—
Insoluble residue	19.800
	99.552

This same limestone showed on the Salisbury and Baltimore railroad, on the north side of the Castleman river, just west of Meyersdale, and about 20 feet above the level of the Castleman river. It has not been worked at that place.

The limestone has been opened up on Tubmill run, about two miles above its mouth, at two places. It is of full average thickness, six or more feet.

On the Beachy place, on the Castleman river, one mile above the mouth of Tubmill run, and one and a-half miles south-west of Salisbury, the limestone has been opened up, only a few feet above the river level. It cannot be measured, but is reported as "twelve feet thick." It is 190 feet by level below the Pittsburg coal bed, but as it is on the rise of the measures, the distance between them is, as before, 210 to 220 feet.

This Barren Measure limestone is therefore as regular and persistent as any deposit in the basin. It is not only found at numerous points, running from the south-east part of the basin, through the centre, and at the north-east and north-west ends, but the same limestone, and the small coal overlying, are found south of Pine Hill Church and at Berlin. This is as far as the Barren Measures cover the region, and it may therefore be said that it has been found lying regularly everywhere in its enclosing measures until the geological structure of the basin has cast it out of the hilltops.

Elk Lick Coal.

The coal overlying the limestone is the "Elk Lick Coal;" a name given originally from an old opening on Elk Lick creek and the Castleman river, and is always called a "four foot bed" of coal of excellent quality.

It must be noted that the Elk Lick coal lies some 350+ feet above the Mahoning Sandstone; and that the very numerous identifications by which the coal beds of the Barren Measures, lying from 75 to 150 feet above the Mahoning Sandstone, have been called the Elk Lick coal, are entirely incorrect. The bed

is a persistent and workable one in the Salisbury Basin, and the name should be retained.

Little Pittsburg Coal and Limestone.

At a regular distance of 50 feet below the Pittsburg coal bed there is found throughout the Salisbury Basin a persistent limestone, averaging 4 to 5 feet in thickness and having on top of it a small coal bed.

This limestone has been exposed in the north end of the basin, but is not worked there.

On the Saylor place, one mile west of Meyersdale, the coal overlying the limestone was once opened. The opening is now fallen shut and the coal cannot be measured. It lies 63 feet by measurement below the nearest opening on the Pittsburg coal bed; but is opened in the direction of the dip of the measures, and the interval between them is not more than 50 feet.

At the Keystone Coal Company's Mines, 2½ miles south-west of Meyersdale, the limestone has never been opened; but the coal overlying it was once picked into, and is reported as a "5 foot coal," including all its partings.

On the hill side, opposite *the village of Mechanicsburg*, the limestone is quarried, 50 feet below the Pittsburg coal bed, and shows full 6 feet of limestone of good quality. The quarry is quite extensive, and much limestone has been burned for agricultural purposes.

The coal shows on top of it, 1 foot thick, or more; but is not worked.

Ten feet of brown slates overlie the coal; and in them show three small beds of carbonate iron ore, apparently regular, and with a hematitic crust from weathering. They are not thick enough to be of practical value.

On the S. S. Flickinger place, two and a half miles north of Salisbury, there is a small quarry on the limestone. Only 2 feet of limestone are showing now, but the bed is apparently of full thickness.

An average specimen of this limestone was forwarded to the laboratory of the Survey, and yielded on analysis: (A. S. M'Creath.)

Carbonate of lime	64.706
Carbonate of magnesia	2.156
Carbonate of iron	4.274
Alumina	1.700
Sulphur	2.431
Phosphorus	.751
Carbonaceous matter	2.602
Insoluble residue	20.660
	99.280

The variation in the thickness of the bed, within short distances, is shown by an opening in the centre of the basin, scarcely one mile east of Flickinger's. Here the limestone has been opened 45± feet below the Pittsburg coal bed, and only shows *one foot thick*; with the small coal in its proper place on top.

Going south-westward down the basin, no opening is found on the limestone until reaching the *J. W. Beachy place,* two miles south-west of Salisbury. It is here opened up in a quarry, and is burned for agricultural purposes. It shows 6½ feet thick, is smooth, of a bluish cast, and breaks with a slightly conchoidal fracture.

The coal overlying it is represented by 3 inches of cannel slate, 2 feet above the top of the limestone.

Ten to twelve feet of black and brown slates overlie the cannel slates.

At the Wilhelm mines, on Tubmill run, 1 mile west of Salisbury, the limestone is not opened or worked, but shows in a ravine, lying about 50 feet below the Pittsburg coal bed, and is not less than 5 or 6 feet thick.

The limestone is therefore a regular and persistent bed, underlying the entire centre of the basin, and averaging about 4 to 5 feet thick.

The coal overlying it is nowhere opened for accurate measurement, but is apparently a valueless bed. It is the *Little Pittsburg Coal Bed* of the old reports; and it is also described by Prof. Stevenson as showing on Chartiers creek, in Washington county, and in a section given by him of the measures in the extreme south-east corner of Greene county.* But it is always in all these cases a small and worthless bed, as in the Salisbury basin.

*Report K, p. 76-77.

This limestone horizon of some 45+ feet below the Pittsburg coal bed is widely extended. In the section quoted above, in the south-east corner of Greene county, it is 40 feet below the Pittsburg coal bed, and has its small coal on top.

Limestones Under the Pittsburg Coal Bed.

There is a limestone, very persistent in character, which is found from 1 to 10 feet below the Pittsburg coal bed. This limestone has never been seen in the Salisbury Basin. In tracing the limestones in Washington and Allegheny counties, Prof. Stevenson says of this "40-foot" limestone: "In central Washington, as well as in southern Allegheny, it is present and sometimes becomes 6 feet thick. From the conditions at Mansfield, in Allegheny county, I am inclined to suppose that the two limestones unite, and that the single limestone, so persistent northward, and which occupies the place of the upper one, represents them both,"

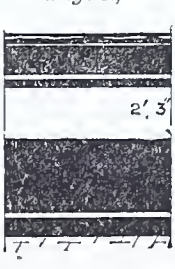
PITTSBURG COAL BED.

The Big Bed, or the Pittsburg coal bed, shows itself throughout the whole Salisbury basin by a beautifully defined bench about half way up the hillside. It is opened and worked at numerous points between the Castleman river at Meyersdale, and the Maryland line.

It will be noted in this detailed description of the different mines that the coal bed varies very much, both in size and quality, in the limited area covered by it.

Saylor Mine.—The most northern opening on the bed in the basin is on the Saylor farm, three-fourths of a mile south-west of Meyersdale. The mine, about 200 yards south of Saylor's house, shows:

Fig. 34.



Slate roof.			
Coal, bony		0′ 6″	
Coal, poor		1′ 4″	
Clay parting		0′ 2½″	
Coal		0′ 4″	
Clay slate, soft	2′ 3″	2′ 3″	9′ 0″
Coal, main bench		3′ 4″	
Clay		0′ 2½″	
Coal		0′ 10″	
Sandstone floor.			

The coal is worked to the north, and the mine drains easily.

A comparison of this measurement with the record of the mines opened in the centre and south end of the basin shows how markedly the coal bed is deteriorated at the extreme north end.

A specimen of the Saylor coal yielded on analysis (A. S. M'Creath.):

Water	1.630
Volatile matter	19.965
Fixed carbon	66.510
Sulphur	0.775
Ash	11.120
	100.000

Coke per cent, 78.405; color of ash, reddish gray.

The percentage of ash in the above analysis is so high that it is probable that the specimen scarcely represented a fair average of the bed.

Two analyses made in 1873 of the coal from the same mine showed (P. Frazer, Jr.):

	1st Analysis.	2d Analysis.
Hygroscopic water	1.790	1.790
Volatile combustible matter	20.890	21.800
Ash	7.980	7.420
Coke (by loss)	69.340	68.990
	100.000	100.000

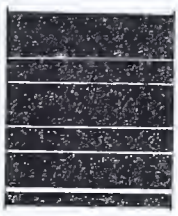
South-west of the Saylor mine the Pittsburg coal bed has been opened up on the *S. Saylor place* and in the *M'Conkey mine*. The coal shows in these mines the same as at the J. Saylor opening. At the M'Conkey mine the exposure shows 12 feet of dark slates and shales overlying the coal. Sandstone directly underlies the coal bed; it is fine-grained, much iron stained and filled with vegetable impressions.

At the *Chris. Livengood mine*, one-half mile south-west of the M'Conkey mine, the coal shows as before. Twenty feet of dark slates here overlie the coal bed.

Cumberland and Elk Lick Mine.—The Pittsburg bed is opened and worked by the Cumberland and Elk Lick Coal Company at their mine on a small run, two miles south-west of Meyersdale. The coal as measured in the mine shows:

Slate roof.

Fig. 35.



Coal	2′ 0″		
Parting	0′ 1½′		
Coal	1′ 1″		
Parting	0′ 1″		
Coal	1′ 10″		
Clay	0′ 1″	8′ 6″	
Coal	1′ 0″		
Clay	0′ 0½″		
Coal	1′ 6″		
Clay	0′ 3″		
Coal	0′ 6″		

At the outcrop at the mouth of the mine the bed shows 8′ 6″ thick, including clay partings. The coal is lowered down from the mine by an incline plane. This places it on to the Salisbury and Baltimore railroad, which has a short branch up the ravine to the mine. The daily shipment (September, 1876) is about 200 tons.

A specimen of the coal forwarded to the Laboratory of the Survey in Harrisburg yielded on analysis (A. S. M'Creath.):

"Water	1.385
Volatile matter	21.470
Fixed carbon	69.352
Sulphur	.763
Ash	7.030
	100.000

Coke per cent, 79.145; color of ash, reddish-gray."

Keystone Company Mine.—The Keystone Coal Company have opened a mine on the Castleman river two and a half miles southwest of Meyersdale.

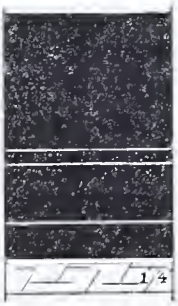
The coal as measured in one of the gangways showed:

Slate roof, hard and tough.

Coal		2′ 0″	
Bone coal, with sulphurous layers on bottom.		1′ 0″	
Coal, clean and good		3′ 0″	9′ 0″
Slate parting	0′ 6″ to	1′ 0″	
Bottom coal		2′ 0″	

At another place in the mine the following section showed:

Fig. 36.



Coal		6′ 0″	
Parting, small.			
Coal	0′ 3″ to	0′ 6″	
Parting, small.			
Coal		2′ 6″	10′ 11″
Slate		0′ 2″	
Coal		1′ 6″	
Slate		0′ 3″	
Sandstone, seen		1′ 4″	

The coal shows well in the mine, being reasonably free from injurious impurities, and mines out well. In structure it is somewhat columnar, though not markedly so. It is firm and bears shipment.

The mine is 180 feet above the Castleman river. The coal is lowered down by an incline plane, and is then carried over a narrow gauge railroad belonging to the Keystone Company to Keystone Junction, on the Pittsburg and Connellsville railroad, a station 3 miles east of Meyersdale.

The mines of the company are in fine condition and well ventilated. The average shipment, (September, 1876,) is about 200 tons daily, going east to Baltimore for use as steam coal. This amount can be largely and quickly increased whenever the market so demands.

A specimen of the coal was analysed at the Laboratory in Harrisburg, and showed (A. S. M'Creath.):

"Water	1.050
Volatile matter	19.610
Fixed carbon	70.239
Sulphur	.761
Ash	8.340
	100.000

Coke per cent, 79.34; color of ash, gray.

The coal has a bright resinous lustre, is compact, and contains some mineral charcoal and iron pyrites."

A specimen of coal from this mine was analysed in 1873, and gave (P. Frazer, Jr.):

Hygroscopic moisture	1.790 (?)
Volatile combustible matter	19.350
Ash	7.790
Coke (by loss)	71.070
	100.000

Yoder Mine.—In the vicinity of Mechanicsburg, 2½ miles west south-west from Meyersdale, the Pittsburg coal bed has been opened and worked in the hills overlooking Elk Lick creek. The outcrop of the bed, however, is confined solely to the eastern bank of the stream.

The coal is mined on the Yoder farm. As measured in the mine it shows:

Roof slate, tough and firm.

Coal	3′ 2″	
Slate parting	0′ 0¾″	
Coal	0′ 6″	7′ 9¼″
Slate	0′ 0½″	
Coal	4′ 0″	

A specimen of the coal analysed at the Laboratory at Harrisburg, yielded on analysis (A. S. M'Creath):

Water	1.465
Volatile matter	21.285
Fixed carbon	69.677
Sulphur	.693
Ash	6.880
	100.000

Coke per cent, 77.25; color of ash, reddish gray."

Beechley Mine.—The Pittsburg bed is also opened on the Beechley property, south-west of the Yoder mine, and shows:

Roof, slate.

Coal, bony	1′ 0″	7′ 0″
Coal	6′ 0″	

Slate.

On account of the water in the mine the coal could not be exactly measured, but the above dimensions of the different benches are very close to the fact. The bottom bench, under the slate, could not be seen.

Graham Mine.—The Graham mine is opened in the broad and deep ravine of Grassy run, about one-half mile above Livergood's mill, which is at the mouth of the run where it joins the Castleman river one mile north-east of Salisbury.

The upper bench of the coal bed is worked in this opening; but as the mine is only carried on for domestic consumption in the immediate vicinity, the main entry is only in a short distance under the hill. Nevertheless the coal shows well. The upper bench is nearly seven feet thick, and shows the small parting as seen in the Keystone Section, Fig. 36. At the mouth of the mine an exposure shows 15 feet of black slate and dark rusty shales resting on top of the coal bed.

The rocks at this point dip apparently to the southeast; but this dip does not obtain farther in the mine.

Livengood and Keim Mine.—The Pittsburg coal bed has been opened on the Livengood and Keim tract, two-thirds of a mile north-east of Salisbury.

The bed shows very handsomely in the mine; only the upper bench is worked. It is here full 7 feet in thickness, and is much more free from slate and other impurities than in the mines at the extreme north end of the basin. The coal comes out in blocks; and as the mine has been worked for many years to supply the local demand, the total output from it has been considerable. The main gangway goes in north-west, and falls slightly, the mine being drained by a ditch.

A specimen of the coal was analysed at the Laboratory of the Survey in Harrisburg, and yielded (A. S. M'Creath.):

"Water	1.665
Volatile matter	22.350
Fixed carbon	68.774
Sulphur	1.246
Ash	5.965
	100.000

Coke per cent, 75.985; color of ash, gray, with pink tinge."

The Pittsburg coal bed has been opened on the Keim tract, adjoining the Livengood and Keim, but the mine is not now worked. It was open in 1870, and when examined at that time* showed a full 10 feet of good clean coal, fully equal in character to that from the Livengood and Keim mine as given above.

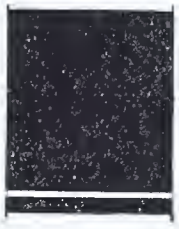
Wilhelm Mines.—On the south side of Tubmill run, 1 mile west of Salisbury, Messrs. Anspach & Co. have opened up the Pittsburg coal bed. The Salisbury and Baltimore railroad has been graded to these mines, though the iron is not yet laid down (September 1876).

The openings are made well up on a high steep hill side; the conditions are very favarable for mining, and the gangways would command a large and unbroken area of coal, lying in an almost horizontal position, or else rising gently to the south-west. For from this point on to the south-west the coal rises in conformity to the structure of the basin as a canoe-shaped synclinal.

*Report of J. P. Lesley.

The bed shows superbly in the mine, measuring thus:

Fig. 37.



Roof, tough black slate.			
Coal	8′ 0″	9′ 0″	
Clay slate	0′ 4″		
Coal	0′ 8″		
Slate in floor.			

The upper bench is without any persistent slate partings, but shows variable knife edges of slate. It carries but little iron pyrites, and the whole 8-foot bench is indeed in a state of wonderful purity.

A specimen of the coal yielded on analysis in Harrisburg (A. S. M'Creath):

"Water	1.190
Volatile matter	21.000
Fixed carbon	66.907
Sulphur	.713
Ash	10.190
	100.000

Coke per cent, 77.81; color of ash, reddish-gray."

The same bed was again opened about 100 yards south-east of this mine by Mr. Wilhelm, former owner of the property. The section of the coal bed is precisely the same as in the drift previously described (Fig. 37), but the rise to the south-west is much more decided.

A. P. Beachy Mine.—Across the brow of the hill, on the eastern slope, the Pittsburg coal is opened and worked, though only for local use. It is known as the A. P. Beachy Mine. The coal bed shows its full thickness as at the Wilhelm Mine, and in an unusually clean and pure state.

Just beyond the A. P. Beachy Mine the outcrop of the Pittsburg coal bed crosses the Grantsville road, winding south and west. A broad flat, too shallow to include the Pittsburg Bed, causes a wide break in the outcrop line, but the smut of the bed darkens the road for the whole distance across, and the flat is really on the bottom of the coal bed.

Harshberger Mine.—The bed is, however, again under cover on the next farm, and is opened and worked by Harshberger, on the *old J. W. Beachy tract*, though the coal has no cover except its roof slates. But these slates have sufficient tenacity and

firmness to furnish the coal with protection enough to have kept it firm and dry.

In the Harshberger Mine the coal is in fine condition. The upper bench is full 7 feet thick, and is without persistent or troublesome slate partings; but irregular knife edges of slate are observable, and also a small amount of bony coal. The clay parting near the base of the coal bed forms the mine floor, and the lower bench of coal is not taken up.

From the Harshberger Mine the line of outcrop of the Pittsburg coal is easily traced along the brow of the hill, keeping close to the Grantsville road. The bed finds its *western limit* near the old shoe shop, situated at the cross roads of the Grantsville and Mechanicsburg roads. But on the opposite side of a shallow ravine, down which *Flag Run* flows, the bed is again found, its outcrop following the course of the road for some distance, and being plainly marked by a prominent bench. It has here been opened on the Harshbarger farm, and again on the Folk place, the coal in both mines appearing well, maintaining its full thickness, and showing great purity. The outcrop of the coal bed crosses the road a short distance south of Folk's mine, and is plainly exposed. The bench caps the hill and winds around to the east of the buildings on the old Miller farm. This is near its final southern outcrop, but the thickness of the coal is in no wise diminished, nor has it suffered in character and quality.

M. J. Beachy Mine.—The Pittsburg coal is opened and worked by Manasses J. Beachy on the old Miller place, but only to a moderate extent for local use. It shows nearly 8 feet of clean coal in the upper bench. It is not without a small amount of bone coal and lenticular masses of slate, but the bed makes a handsome show. The lower bench is not taken out, the clay parting constituting the floor of the drift.

A specimen of the coal analysed at the Laboratory of the Survey in Harrisburg yielded (A. S. M'Creath.):

"Water	1.680
Volatile matter	21.010
Fixed carbon	69.016
Sulphur	.764
Ash	7.530
	100.000

Coke per cent, 77.31; color of ash, gray, with red tinge."

The coal has here plenty of cover. It is at this place that the unusual feature is presented of a massive limestone, 10 feet thick, (the Redstone limestone,) coming in 30 feet above the floor of the Pittsburg coal bed; and this same limestone is only found at one other point in the basin. The section of these measures has already been given in fig. 27, page plate VII.

The hill rises 15 feet above the limestone, and the hill top is covered thickly with pieces of broken fine grained sandstone much iron stained. This sandstone outcrop can be followed southwest for a quarter of a mile along the flat surface to the Jonas Beachy farm, and there shoots out finally to daylight, disappearing with the Pittsburg coal bed, these measures not being found in the bluffs across the Maryland border.

The Pittsburg coal bed is last seen at the extreme south border of Somerset county, on the Jonas Beachy farm (now owned by Anspach & Co.) where it was opened in a clump of woods west of the road. It has abundance of cover, and the fine-grained rusty sandstone, noticed at the old Miller place, is seen here. *But the limestone has never been found*, and apparently disappears from the measures at Miller's. It does not seem, however, that properly directed search has been made for it on the Jonas Beachy tract.

S. P. Miller Mine.—The coal as measured in the mine shows:

Roof, slate.
Coal ..... 8′ 0″
Slate.

The bench of coal underlying the slate floor of the mine, reported to be 18 inches thick, is not taken out, the slate parting making the floor.

The main bench of the coal is 8 feet thick, clean and without persistent slate partings; but in one place in the mine there shows in the floor a bulge of horseback one foot thick.

The Rider Coal of the Pittsburg Bed.

In the southern half of the Salisbury coal basin a variable coal bed, running up to 5 feet in thickness, comes in over the Pittsburg bed.

At the M. J. Beachy opening on the old Miller farm, at the extreme south-west end of the basin, the rider coal does not show, but *is reported* to be only 4 feet above the top of the Pittsburg coal bed.

Coming north from the Beachy mines the rider coal is opened at the *Wilhelm mines on Tubmill run*; the bottom of the upper coal is there 6 feet above the top of the Pittsburg bed.

The coal as measured in the mine shows:

Fig. 33.

Slate roof.			
Coal	0′ 9″		
Slate	0′ 1½″		
Coal	0′ 2½″		
Slate	0′ 2″	6′ 1″	
Coal	0′ 2″		
Slate	1′ 0′		
Coal	3′ 8′		
Slate floor			

The main bench of the coal is of excellent character, but the intermingled coal and slate layers above it are entirely worthless for any practical purpose.

A specimen of the main or lower bench of the coal was analysed at the Laboratory at Harrisburg, and showed (A. S. M'Creath.):

"Water	1.570
Volatile matter	21.450
Fixed carbon	69.986
Sulphur	.679
Ash	6.315
	100.000

Coke per cent, 76.980; color of ash, reddish gray."

The above analysis shows a good coal, the striking feature being its almost exact resemblance to the analysis of the coal from the Pittsburg coal bed main bench.

The upper or rider coal shows everywhere through this southern centre of the basin, ranging from 6 to 12 feet above the main bed.

On the A. P. Beachy place, one-third to one-half of a mile east of the Wilhelm mines, the outcrop shows the following section, the exposure being due to a break off on the steep bench of the soft rocks separating the coals. The section is:

Outcrop of rider coal.			
Fire clay, weathered, Brown slates, Black slate	Interval	1′ 0″	6′ 0″
		4′ 0″	
		1′ 0″	
Pittsburg coal bed.			

At the Livengood and Keim Mine it shows on the outcrop, separated from the main bed by 12 feet of black slates and shales.

It is not opened there for working, but was once opened in a ravine back of the mine, and was called the "5 foot bed."

At the Graham mine, one-half of a mile north of Livengood and Keim's, the opening showed full 18 feet of dark slates overlying the Pittsburg coal bed main bench, but *there was no sign at all* of the existence of the rider coal.

And from this on to the north end of the basin in all the numerous places in which the roof slates of the Pittsburg coal bed were exposed, in some cases 20 feet of overlying black slates, *the rider coal was missing.*

Mr. De France, Superintendent of Keystone Colliery, says that he has *never found any rider coal* over his Pittsburg bed. He finds roof slates 10± feet, and sandstone overlying that for 20 feet.

There is nothing specially surprising in this variation. In the Connellsville region the small rider coal over the Pittsburg bed, lying, as in this case, in black slates, shows great and sudden changes in its distance from the top of the main bed; and in the Clearfield region a rider to Coal Bed B, lying also in black slates and shales, varies in distance from the main bench from 2 to 12 feet within a moderate area.

This rider coal, therefore, can only be said to be a valuable coal bed, yielding $3\frac{1}{2}$ to 4 feet of coal, in the centre and southern centre of the basin, a very moderate area.

THE RED STONE COAL BED.

The measures overlying the Pittsburg Coal Bed, are 20 feet of black slates, then 24 feet of gray slates and shales to a coal bed.

This order of measures is nowhere disturbed except where the M. J. Beachy limestone is found in this interval at the southern end of the basin.

The "middle coal bed," called the Redstone coal bed in the identifications of the Final Report, keeps its regular distance everywhere throughout the basin, that is forty-four feet above the Pittsburg coal bed; but it is nowhere worked except where it is quarried out with the limestone at the Beachy quarry. The outcrop, however, shows in many places. It is found at *Keim and Livengood's*, and on both sides of Grassy run, 1 mile

north of Salisbury. It outcrops there above the Graham mine (on the Pittsburg coal bed), and on the *south side of the run* has been opened up sufficiently for measurement. The roof and floor are here pitching steeply, giving to the measures an apparent irregularity which the absolute regularity of the overlying limestone shows to be impossible. It is simply what in a mine would be "a swamp," or "a trouble," and does not disturb the great average evenness of the measures in the central part of the basin. The coal as measured in the mine shows:

Roof, sandstone.		
Dirt and slate	0′ 6″	
Coal	2′ 0″	
Parting.		
Coal	1′ 3″	5′ 1″
Slate	0′ 1″	
Coal	1′ 3″	
Floor, dull clay.		

It was once opened up for testing *at the Keystone mines*, two and a-half miles south-west of Meyersdale. It is there found forty feet above the Pittsburg coal bed. It showed, according to the statement of Mr. De France, Superintendent, as a 5 foot bed, but includes in this a band of slate fully 1 foot thick, making 4 feet of coal. Drifts were started in on the bed, but it was never developed except for measurement. The statement of the measurement is:

Slate roof.		
Coal Parting Bone Coal	1′ 6″	5 6″
Coal	4′ 0″	

A specimen of the coal from one of the trial drifts was forwarded for analysis. It had been lying exposed to the weather for about a year. The analysis gave (A. S. M'Creath.):

"Water	1.290
Volatile matter	20.865
Fixed carbon	67.201
Sulphur	1.839
Ash	8.805
	100.000

Coke per cent, 77.845; color of ash, reddish gray.

On the outer surface the coal has a dull lustre. On fresh fracture it is bright and shining. It is quite compact, and shows numerous partings of iron pyrites."

The coal is very similar in character to that yielded by the Pittsburg bed, but is much more sulphurous.

From the Keystone Mines north-eastward to the end of the basin, the Middle bed is seen everywhere outcropping 40 to 45 feet above the Pittsburg coal. But in the presence of the larger and better bed below, it is never opened and worked in any part of the region.

THE PITTSBURG LIMESTONE GROUP.

There are found in the Salisbury Basin three limestones overlying the Pittsburg Coal Bed—

1. The "Upper Limestone," 160 feet above the Pittsburg coal bed.
2. The "Middle Limestone," 90 feet above the Pittsburg coal bed.
3. The Redstone Limestone, 30 feet above the Pittsburg coal bed.

The "upper" and "middle" limestone are regular and persistent, and are traced throughout the basin wherever the hills over the Pittsburg coal bed are high enough to take them in. They have in each case a small coal bed on top of them.

The "Redstone Limestone" presents some curious features, and has been the cause of much confusion in the past. It is opened and quarried by Mr. Beachy on the old Miller place, at the extreme south-west end of the basin. On top of it is found a coal bed, (Redstone?) which is here, as at numerous other places in the basin, 44 feet above the Pittsburg coal bed.

This limestone has not even been found on the adjoining properties; and is only reported as having once been opened, one mile south of Mechanicsburg. Throughout the rest of the basin it has not been found; and outcrop exposures at the Keystone Coal Company's mines, together with the record of the air shaft at the same place, show that the limestone probably does not exist at all in the northern end of the basin.

The exposure at M. J. Beachy's gives the following section:

Fig. 39.

Surface.		
Coal	0′	2″
Parting	0′	2½″
Coal	0′	6″
Parting	0′	1″
Coal	2′	3″
Clay	0′	9″
Black bituminous clay	0′	2″
Black slate, with nodular iron ore	3′	0″
Limestone and shale	1′	3″
Impure fire-clay	1′	10″
Limestone	10′	0″
Interval, slates	10′	0″
Coal reported	3′	0″
Slate	4′	0″
Coal, Pittsburg	10′	0″
Total	47′	2½″

A specimen of this limestone yielded on analysis (A. S. M'Creath.):

"Carbonate of lime	86.625
Carbonate of magnesia	6.152
Carbonate of iron, Alumina	1.825
Sulphur	.093
Phosphorus	.023
Carbonaceous matter	—
Insoluble residue	4.040
	98.758"

It has already been stated that the presence of this massive limestone, with its base only 20 feet above the top of the Pittsburg Coal, has caused much confusion in the identifications in the basin, and repeated errors in doubling up the measures.*

The vertical sections (Page Plate VII) in showing the general geology of the basin have shown two regular limestones overlying the Pittsburg coal bed by distances of 90 feet and 160 feet. Over each of these beds, moreover, is found a bed of coal, carrying much slate, and of no practical value, but still regular and persistent. The sudden coming in of this Beachy (Redstone) limestone, just under the coal bed which keeps so regularly 45 feet above the floor of the Pittsburg Coal Bed, and the general similarity of the massive Beachy limestone to the massive limestone which lies 90 feet above the Pittsburg Bed, has naturally rendered the conclusion almost inevitable that this limestone at Beachy's was the same as the limestone at Livengood and Keim's mine.

If this were so, one of two things was the case. Either the 90-foot interval between the coal and limestone at Livengood and Keim's had come down to a 30-foot interval at M. J. Beachy's, a distance of $3\frac{1}{2}$ miles; or if the interval has not decreased between the coal and the limestone, then the Beachy coal was not the Pittsburg coal bed, but a coal overlying it by 50 to 60 feet.

Neither of these two statements is true. The Beachy coal and the Livengood and Keim coal are the same bed, that is the Pittsburg coal bed; the rider coal varies somewhat in its interval distance above the roof of the Pittsburg coal bed, and the Beachy limestone is entirely distinct and separate from the limestone at Livengood and Keim's.

Nor is the non-persistence of the Beachy limestone a matter of special moment or of unusual character. In this same basin the very regular limestone 90 feet above the Pittsburg Coal Bed shows in the north-west part of the basin in its full thickness of 8 to 10 feet; yet not over one mile away it is seen not

*Though an unusual place for a limestone deposit in some parts of the State of Pennsylvania, yet in the Second Basin, in the Ligonier valley, it is found in the same position as a regular deposit. This is shown in the comparison of the Salisbury Basin sections already given. (F. R. 1858.)

Sections of the Salisbury Basin in Somerset Co.

Second Geological Survey of Pennsylvania, by P. & W. G. Platt.

R. of P. HH. 1875'6.

Fig. 29 — North end of the basin.

400' feet.
350'
300'
250
200'
150'
100'
50'
Level of 0'

- L. 10' — 2 Coal, 1-6 clay.
- ? 42' — chiefly slates
- brown sh. 3'
- bl. sl. 15' — 1' Coal, 1' clay
- L. 5' — Coal
- ? 52'
- ? 15' — Coal crop
- bl. sl. 20'
- 10' Coal
- S.S.
- ? 55'
- Coal (Saylor)
- ? 135'
- L. 14'
- S.S. 5' — Elk-lick Cr.

Fig. 30.

- L. 10' — Coal 1-6 clay
- ? 113'
- S.S. 15' — 4' Coal.
- bl. sl. 20'
- 10' Coal
- S.S. 5'
- ? 74'
- 1+ Coal
- ? 8'
- Sandstone & shale layers 38'
- iron stained
- brown sh. 15'
- thin bedded 12'
- ? chiefly Sandstone 28'

Casselman's River

Sub-mill run

Fig. 31.

- ? 60
- L. reported — bench.
- ? 55'
- 4' Coal rider.
- bl. sl. 13'
- 10' Coal.
- ? 50'
- 6'
- sl. 21' — 2' Coal.
- sh. 15' — ore-balls coal.
- 35'
- ore-balls
- ? 13' — ore-balls coal.
- S.S. 5'
- 6'
- ? 53'
- 5'

Fig 32.

- Grey clay 52'
- States.
- clay & sh. 3'
- L. 10' — 1' Coal 3' clay
- ? 20'
- S.S. 6'
- ? 39'
- 4½ Coal.
- bl. sl. 11'
- 10' Coal.
- sh. 31'
- Coal crop (small)
- sl. 20' — Coal smut.
- sh. 27' — coal crop
- chiefly soft sh. & thin Sandstones 60'

Casselman's river

Fig. 33.

- ? 15
- S.S. 9'
- ! 11'
- 6'
- L. 10'
- ? 12' — 3-4" Coal
- bl. sl. 4' — 10' Pittsburgh

Coal.
F.C Fire clay.
L. Limestone.
S.S. Sand stone.
bl. sl. Black Slate.
sh. Shale.

over one foot thick, and sections in that vicinity might easily show it entirely wanting.

THE MIDDLE (SEWICKLY) LIMESTONE AND COAL.

The Middle limestone is but little opened in the basin. It lies 90 feet above the Pittsburg coal bed; and keeps this distance with great regularity. Even where not opened it shows itself in numerous places by its well defined bench running around the hillsides.

The limestone is opened *above the Saylor mine*, one mile west of Meyersdale, and shows itself 5 feet thick. It is divided into two layers, the upper one of which is fossiliferous, and of a much lighter color than its congener below. The quarry has been recently opened and but little limestone has been removed.

An average specimen of this limestone was analysed at the Laboratory at Harrisburg, and yielded (D. M'Creath.):

"Carbonate of lime	69.160
Carbonate of magnesia	15.535
Carbonate of iron	3.935
Alumina	1.366
Sulphur	.046
Phosphorus	.017
Insoluble residue	9.730
	99.789"

The outcrop of the small overlying coal bed, 1+ foot thick, shows in the road beyond the quarry. Light brown shales overlie the coal, which is apparently underlaid by a stratum of impure fire-clay.

On the Beechley place, 3 miles south-west of Meyersdale, the same bed of limestone, separated from the Pittsburg coal bed by the same interval rocks as before, has been quarried and burned, though only to a small extent. The quarry was not being worked when examined, and the wash from above had in large part concealed the face of the limestone; but it was apparently not diminished in size.

The outcrop of a small coal bed shows three feet above the top of the limestone. The latter has been quarried on the *Chris. Livengood farm*, 1½ miles south-west of Meyersdale. It is of full thickness.

The bench of the limestone has been picked into at numerous places in the centre of the basin, but going south-westward

no quarry is found upon it until reaching the *Keim and Livengood* mine, one-half mile north of Salisbury. It is here extensively quarried and burned for agricultural purposes. The quarry shows:

Surface soil.	
Clay and shale	3′ 0″
Coal	1′ 0″
Clay and dirt	1′ 0″ to 3′ 0″
Limestone	1′ 0″
Parting.	
Limestone	4′ 0″
Clay	1′ 0″
Limestone	2′ 0″
Total	15′ 0″

The limestone is opened and worked on the *J. M. Hayes place*, one-half of a mile west of the Keim and Livengood quarry. A specimen of the limestone was analysed at the Laboratory of the Survey and yielded (D. M'Creath.):

"Carbonate of lime	74.803
Carbonate of magnesia	6.734
Carbonate of iron	5.282
Alumina	1.548
Sulphur	.052
Phosphorus	.070
Insoluble residue	11.510
	99.999"

On the south side of Tubmill run the limestone shows itself as a bench in the hillside 90 feet above the opening on the Pittsburg coal bed at the Wilhelm mines, but is not opened there. From this point south-westward the hills are not high enough to take in the bed.

So far as the evidences go, it may be said that this limestone is a very regular bed, and averages 6 to 8 feet in thickness. The coal overlying it is apparently entirely valueless.

THE UPPER (UNIONTOWN) LIMESTONE AND COAL.

The upper limestone is opened and worked at numerous places in the basin. It lies 160 feet above the Pittsburg coal bed, and is so regular that it can always be found and opened whenever the hills rise to the requisite height.

At the extreme north end of the basin it is found crowning the highest crest of the hill on the *Saylor place*, three-fourths

of a mile west of Meyersdale. It is here without cover, is much broken, and does not show its top. It is filled with fossil shells.

On the hill, one-half mile to the south-west of this opening, it is extensively quarried and burned for agricultural purposes. The quarry shows:

Surface.	
Coal	0′ 2′′
Parting	0′ 1½′′
Coal	1′ 10′′
Clay and dirt	1′ 6′′
Limestone	1′ 6′′
Clay	0′ 10′′
Limestone	10′ 0′′
Total	15′ 11½′′

An average specimen of this limestone was analysed at the Laboratory of the Survey and yielded (D. M'Creath.):

"Carbonate of lime	85.732
Carbonate of magnesia	5.098
Carbonate of iron, Alumina	2.871
Sulphur	.104
Phosphorus	.037
Insoluble residue	6.220
	100.062"

The small coal overlying is sufficiently good to use for burning the limestone.

Between the north end of the basin and Grassy run, a distance of 2½ miles, the limestone is quarried in numerous places. South of Grassy run the hills in no case rise high enough over the Pittsburg coal bed to take in the upper limestone.

At the Keystone Coal Company's mines, 2½ miles south-west of Meyersdale, the limestone is extensively quarried. The bottom of the limestone is at this point 160 feet above the Pittsburg coal bed. The opening shows the following measurement:

Surface.	
Impure fire clay and slaty shale	2′ 0′′+
Coal	0′ 10′′
Parting	0′ 0½′′
Coal	2′ 4′′
Fire clay	0′ 2′′
Clay shale	0′ 11′′
Limestone	8′ 0′′
Total	14′ 3½′′

The full thickness of the limestone bed is not shown, but it is apparently of the average size.

The coal bed is filled with small wedges of slate.

The upper limestone is opened and worked on the *Beechley farm*, one mile west of the Keystone mines. The quarry shows (the measurement being made by Mr. C. A. Young) as follows:

Black slates.	
Poor limestone	1′ 6″
Slate	1′ 0″
Poor limestone	1′ 0″
Slate	1′ 0″
Coal	2′ 0″
Fire clay shale	1′ 0″ to 1′ 6″
Limestone not seen to bottom.	
Total	8′ 0″

The same limestone is opened on the north bank of Grassy run, above the Graham mine, and showed of full size as at the quarries already described above.

This is the last appearance of the upper limestone. From the north end of the basin to this point, a distance of $4\frac{1}{2}$ miles, it is always found wherever the hills are high enough to take it in. It is a regular bed, of excellent character, and averages fully ten feet of limestone.

For convenience of reference, and at the same time to illustrate the wide variation in the character of the limestones of the Salisbury Basin, the analyses are grouped together below.

	1	2	3	4	5
Carbonate of lime	85.732	69.160	86.625	64.706	55.589
Carbonate of magnesia	5.098	15.535	6.152	2.156	14.225
Carbonate of iron	2.871	3.935	1.825	4.274	6.835
Alumina		1.366		1.700	2.886
Sulphur	.104	.046	.093	2.431	.185
Phosphorus	.037	.017	.023	.751	.032
Carbonaceous matter	.....	.....	.....	2.602	.....
Insoluble residue	6.220	9.730	4.040	20.660	19.800

No. 1. Saylor (Uniontown) Limestone, 160′ above Pittsburg coal bed.

No. 2. Saylor (Sewickley) Limestone, 90′ above Pittsburg coal bed.

No. 3. Manasses Beachy (Redstone) Limestone, 30′ above Pittsburg coal bed.

No. 4. Flickinger (Little Pittsburg) Limestone, 50′ below Pittsburg coal bed.

No 5. Yoder (Elk Lick) Limestone, 215′ below Pittsburg coal bed.

AMOUNT OF COAL IN THE BASIN.

The cross section of the basin (Plate IV) shows:

1. The Lower Productive Coal beds, starting down from the crest of the Allegheny Mountain and Negro Mountain, occupy above water level only the foothills of the mountains for a distance of about one and one-half miles down from the crest. At that point they pass beneath the Lower Barren Measures.

The sketch shows the Lower Barren Measures with their underlying Lower Productive coals, passing under the Upper Productive Coal system of the central plateau, where alone the Pittsburg Coal Bed is found. The large map (Plate XVIII) shows the rising out of the basin to the north and south, and with the cross section (Plate IV) illustrates the canoe-shaped synclinal.

The facts as given above indicate the method of computation used in making some estimates of the total coal tonnage, above and below water level, now lying in the Salisbury Basin.

The Lower Coals.

The amount of coal to be yielded by the lower coals scarcely needs at this time any extended notice. In view of the small cost at which coal can be mined from the Pittsburg coal bed in the centre of the basin, there is but little inducement to attack the smaller and more parted coal beds of the Lower System.

The basin holds of these *latter coals*, *above water level*, a belt along the Allegheny Mountain about one mile wide and nine miles long from the Maryland line to Flaugherty's run; and the same amount on the flank of Negro Mountain, in all about 18 square miles, or 11,520 acres.

Each foot of coal yields, in gross, 1,600 tons to the acre.

There are apparently in this region three workable beds of coal in the Lower Productive system. It has been already shown how little they have been picked into and how difficult it was to secure sufficient reliable measurements to enable an

average to be made of the available coal in the different beds. When the coals are more completely opened the calculations can easily be made on the above basis of acreage.

The total acreage of coal below water level, on the lower beds, would be about 36 square miles or 23,040 acres in all. The depth of the lowest coal below the surface varies from zero at the outcrop to a maximum depth of about 600 to 700 feet in the centre of the basin. In view of the enormous amount of these coals to be found above water level and economically available, this deep lying coal has but little prospect of being mined for many years to come.

The Lower Barren Measure Coals.

These coal beds may be dismissed as practically worthless, except perhaps the Elk Lick coal bed found 200 feet below the Pittsburg coal bed. This coal has been worked in the past, and is reported as a "4 foot bed." It is not now opened for measurement in any part of the basin. The area covered by it is about 9,000 acres. It outcrops all around the central ridge of the basin, and is nearly everywhere accessible and well situated for mining.

The Pittsbury Coal Bed.

The area covered by the Pittsburg Coal Bed naturally subdivides itself into three parts.

1. The area lying between the north end of the basin and Grassy run.
2. The area between Grassy run and Tubmill run.
3. The area between Tubmill run and the Maryland line.

1. *From the North End of Grassy Run.*

The outcrop line of the Pittsburg Coal Bed is shown in the topographical map accompanying this report (Plate XVIII). This line has been carefully run out instrumentally. Part of the work was done when snow was on the ground, and this may render the crop line not absolutely exact at some points; but such variation must be very slight.

Starting with the eastern line of the outcrop of the coal on the north end of the Saylor hill, at the north end of the basin, the outcrop line runs round south-westward up the small ravine of Saylor's run to the J. Saylor Mine on the west side of Saylor run. Turning just above the mine the outcrop runs

back to the north-east on the east side of Saylor run, and rounding the point of the hill comes out into the west bank of the Castleman river.

Running along south-westward on the bank of the river, the coal is found opened at the M'Conkey and Chris. Livengood mines. It continues along the river front until it enters the broad valley of a small run upon which the Cumberland and Elk Lick Coal Company are now working extensively. The outcrop follows up the north bank of the run for fully one mile, then turns and comes back upon the south bank, out on to the Castleman river again.

Following up the west bank of the Castleman, the coal is found opened and extensively worked by the Keystone Coal Company. Thence the outcrop follows up the river, around a bold promontory, goes up a small valley, and then enters the broad and deep valley of Grassy run. This valley cuts the basin through, and makes a heavy deduction from the coal acreage.

The coal is found opened at Graham's mine on the north bank of the run. From here, keeping on the north side, it follows the sinuosities of the numerous small forks of Grassy run, and finally comes out to daylight on the west side of the basin.

This western line of outcrop runs north-eastward in a tolerably straight line, broken, of course, by occasional ravines, none of which are either broad or deep, passes close to Mechanicsburg, where it is opened at the Yoder mine, keeps along the east bank of Elk Lick creek, and runs on steadily to the north-east until it rounds the hill and comes to the point of starting on the north point of Saylor's hill, at the north end of the basin.

As will be seen by referring to the map, there are two almost separate hill tops of the coal on Grassy run, which, though connected, are yet separate for any question of mining; and there is the third unbroken area from these hills to the north end of the basin. The acreage of coal is:

	Acres.
First Grassy Hill	231.4
Second Grassy Hill	88.8
Grassy run to mouth of Elk Lick	2,468.5
Total acreage	2,788.7

Estimating the coal at 8 feet thick through this region, or say 12,000 tons to the acre (in gross) would give 33,000,000 tons of coal in the Pittsburg coal bed in this northern and northern middle part of the basin. There are, of course, places where no such amount of merchantable coal will be yielded by the bed; and there must be deducted a heavy loss of coal in mining. But even with these deductions there is an enormous amount of coal tonnage to come out of this section.

Throughout all this northern part of the basin the conditions are very favorable for mining. The deep cutting ravines and the outcrop on the Castleman afford abundant opportunities for attacking the coal cheaply at almost any point where it may be desirable to open a colliery.

2. *From Grassy Run to Tubmill Run.*

Between Grassy run and Tubmill run there are two separate hills holding the Pittsburg coal bed, the *Jas. Keim hill* and the *Keim and Livengood hill.* The upper limestone is entirely absent from this region, much of the hill top has been carried off, and the Pittsburg coal bed scarcely covers one-half of the area enclosed between the streams.

Keim and Livengood Hill.—Starting the outcrop line on the point of the Keim and Livengood hill, on the Castleman river just south of Grassy run, the crop line follows up the Castleman on its west bank, and is opened at Keim and Livengood's mine in beautiful condition. The outcrop continues up the river for nearly a mile, gradually drawing farther from the bank, and at that point suddenly leaves the river entirely and strikes west across the basin. It makes a crenulated, but in the main tolerably direct line, to the west side, near the head of Grassy run, then turns sharply and follows down Grassy run, on the south side of the valley, and except for slight indentations caused by small branches of the run, keeps straight to the starting point on the Keim and Livengood hill. The acreage of this area in the Keim and Livengood hill is 461.7 acres.

The bed runs fully 10 or 11 feet thick through this section. With 12,000 gross tons to the acre as before, the coal held in the Pittsburg bed in this hill would amount in all to five and a half million tons. From this there should be deducted out-

crop coal and loss in mining to estimate the actual output of coal to come from this area.

Jos. Keim Hill.—On the hill south of this last outcrop line, separated from it by only an interval of 100 yards, on the Jos. Keim place, two miles north-west of Salisbury, there is an egg shaped patch of the Pittsburg coal bed, holding in all 36.8 acres.

The cover on the bed is sufficient to secure good sound coal; but the area is scarcely sufficient to establish a colliery. It will doubtless yield in the aggregate much coal for local use; but as it will not probably be shipped out of the basin, the tonnage need not be estimated.

3. *From Tubmill Run to the Maryland State Line.*

In the region between Tubmill run and the Maryland line there are three separate areas of the Pittsburg Coal Bed. The basin is here rising rapidly to the south-west, and the effect is to bring the outcrop closer to the hilltop and finally shoot it out to daylight.

The Wilhelm Hill.—The first area is in the Wilhelm hill. The outcrop is found opened up in beautiful condition at the Wilhelm mine on Tubmill run, $1\frac{1}{4}$ miles west of Salisbury. From this mine the outcrop sweeps around to the east, is opened up on the adjoining place, (Beachy,) and after circling around comes back to its starting point, enclosing in all an oval shaped area of 122.6 acres.

The cover over this is abundant, the coal in splendid condition full 10 feet thick, and the conditions are very favorable for getting the coal out cheaply.

At 12,000 tons gross to the acre, as before, the total tonnage of coal held in this hill by the Pittsburg coal bed, would be one and one-half millions of tons in all.

In the A. P. Beachy hill, one-third of a mile south of the south out-crop of Wilhelm hill, on the A. P. Beachy place, there is an oval shaped hill holding in all of the Pittsburg coal bed 35.2 acres.

The cover is good, but the area is too small for a colliery; though it will yield much coal for local use.

In the M. J. Beachy hill, three miles south-west from Salisbury, at the extreme south-west end of the basin, there is an irregularly oval shaped area of Pittsburg coal bed. The M. J.

Beachy and S. P. Miller mines are opened on the outcrop and show the coal in full thickness of ten feet and in fine order. The total area enclosed in the outcrop line is 170.2 acres.

The cover is good, and the conditions are favorable for mining.

Taking 12,000 gross tons of merchantable coal to the acre would yield for this M. J. Beachy hill the amount of 2,000,000 tons of coal held in the Pittsburg coal bed.*

The resumé of the total acreage of the Pittsburg coal bed in the Salisbury basin is as follows:

1. Grassy Run to north end of Basin—		
First Grassy run hill	231.4	
Second Grassy run hill	88.0	
Grassy run to North End	2,468.5	
		2,788.7
2. Grassy run to Tubmill run—		
Keim and Livengood hill	461.7	
Joseph Keim hill	36.8	
		498.5
3. Tubmill run to Maryland line—		
Wilhelm hill	122.6	
A. P. Beechy hill	35.2	
M. J. Beechy hill	170.2	
		328.0
Grand total acreage		3,615.2

It needs no elaboration of these figures to show that the most valuable part of the basin, and that to be depended on for extensive shipments of coal, lies between the north end of the basin and Grassy run.

The Pittsburg Limestone Group.

Wherever throughout the basin the hills rise 90 feet above the Pittsburg coal bed, the middle limestone, 8 feet thick, can be opened; and wherever the hills rise 155 feet above the coal, the upper or Great Limestone, 10 to 12 feet thick, can be opened. These conditions obtain over so large a part of the basin as to make the amount of limestone so great as not to need estimation in tons.

*These calculations have been made by Mr. R. H. Sanders from his topographical map of the basin, Plate XVIII.

CHARACTER OF THE COAL.

In general character the coal from the Pittsburg bed in the Salisbury basin resembles the coal coming from the same bed in the Cumberland basin, and resembles even more closely the coal yielded by one of the beds of the Lower Productive Coal Measures in the Clearfield region. For convenience of comparison some analyses of coals from these regions are tabulated below:

Pittsburg Bed in the Salisbury Basin.

Water	1.385	1.050	1.665	1.680
Volatile matter	21.470	19.610	22.350	21.010
Fixed carbon	69.352	70.239	68.774	69.016
Sulphur	.763	.761	1.246	.764
Ash	7.030	8.340	5.965	7.530
	100.000	100.000	100.000	100.000
Coke	77.145	79.340	75.915	77.310

**Pittsburg Bed in the Cumberland Basin.*

Moisture	0.669	0.446	0.893	3.125
Volatile matter	14.984	15.532	15.522	14.168
Fixed carbon	76.264	76.688	74.289	68.438
Sulphur	———	———	———	0.714
Ash	8.083	7.334	9.296	14.933
	100.000	100.000	100.000	100.000
Coke	84.347	84.022	83.585	85.829

Clearfield Coals.

Water	0.810	0.780	0.710	0.765
Volatile matter	20.640	21.680	23.400	20.090
Fixed carbon	74.023	73.052	72.218	74.779
Sulphur	.507	.688	.532	.666
Ash	4.020	3.800	3.140	3.700
	100.000	100.000	100.000	100.000
Coke	78.550	77.540	75.890	79.145

The experiments of Prof. Johnson as to the calorific efficiency of different fuels showed that as a steam raising coal the Cumberland coal ranked *first*.

The similarity of the Salisbury coal to that yielded from the Cumberland basin is sufficiently great to render it sure that for all steam raising purposes it should take a high rank. Already some 300 to 400 tons daily, about 100,000 tons yearly, are being shipped from the basin for steam coal.

* Analyses by Prof. Walter R. Johnson.

The percentage of sulphur runs very low on the average; and the coal is an efficient and clean fuel for puddling furnaces and rolling mills.

Specific Gravity of the Coals.

Mr. A. S. M'Creath determined the specific gravity of the coals to be as follows:

Saylor Hill coal, Pittsburg bed.....	1.387	1.392
Wilhelm mine, Pittsburg bed.....	1.363	
M. J. Beachy's mine, Pittsburg bed.....	1.312	

The specific gravities of six specimens of Cumberland coal are (Johnson):

1.431
1.337
1.307
1.313
1.332
1.414

The specific gravities are very close to those of the Salisbury coals.

It may therefore be said of the Salisbury coal from the Pittsburg bed that one solid cubic foot of coal will weigh from 82 to 86 pounds; and one cubic foot of mined coal from 51 to 53 pounds.

IRON ORES.

The carbonate iron ores of the Lower Productive System have been described in the resumé of those measures. In the Lower Barren Measures and the Upper Productive Coal Measures, the amount of carbonate iron ore so far showing is entirely unimportant.

In the Barren Measures no regular deposit of consequence was seen. At several points there are numerous iron ore balls, in some cases closely wedged for a short distance, but nothing which from its outcrop show could be called a regular, continuous, and workable iron ore bed.

In the Upper Productive Measures the sections on Tubmill run, and at Livengood and Keim's mine, show several layers of carbonate iron ore; but always as balls, or in thin or irregular beds. These, of course, are also only seen on their outcrop, and the outcrop offers no special reason to anticipate any valuable deposit at these points.

The opening up of the outcrops, especially the most important one in the Lower Productive Measures, is well worthy of attention. The cheapness of the excellent coal, and the abundance and accessibility of the limestone, need only to be supplemented by an abundance of carbonate iron ore to give the basin great natural advantages in making iron cheaply.

RAILROAD ROUTES TO MARKET.

The present routes for shipment of the Salisbury coal to market, are

	Miles.
1. From mines on the Salisbury and Baltimore Railroad to the junction with the Pittsburg, Washington and Baltimore Railroad, - - - - - -	1 to 4
This may be averaged at the distance from Salisbury to the junction, say - - - - - - - -	6
2. Salisbury Railroad Junction at Meyersdale via the Pittsburg and Baltimore Railroad.	
To Pittsburg, - - - - - - - - -	110
Add to Junction, - - - - - - -	6
Salisbury mines to Pittsburg, - - - -	116
3. Salisbury Railroad Junction via Pittsburg, Washington and Baltimore Railroad.	
To Cumberland, - - - - - -	39
Cumberland to Baltimore via Baltimore and Ohio Railroad, - - - - - - -	178
Add to Junction, - - - - -	6
Salisbury mines to Baltimore, - - - -	223
4. Salisbury Railroad Junction to Bridgeport via Pittsburg, Washington and Baltimore Railroad, -	26
Bridgeport to Mt. Dallas, Bedford and Bridgeport Railroad, - - - - - - -	28
Mt. Dallas to Huntingdon, H. & B. T. R. R., -	44
Huntingdon to Philadelphia, Penn'a. R. R., -	202
Add to Junction, - - - - -	6
Salisbury mines to Philadelphia, - - -	306

The Salisbury and Baltimore Railroad is now running from the junction of the Pittsburg and Connellsville Railroad, near Meyersdale, to the Cumberland and Elk Lick Company's mine. It needs only a few miles more, (the grading and masonry are already done, and only the iron is needed) to carry the road to Grassy Run. This, with short branches up the small runs, will afford an outlet for nearly all the coal between the north end of the basin and Tubmill Run.

The Pittsburg bed should yield to good mining from 9,000 to 10,000 tons of coal to the acre wherever the coal is in full size and condition; and when it is considered that an annual yield of one million tons would exhaust yearly only one hundred acres of the coal area, it is plain that many years must elapse before the coal from the Pittsburg bed in the Salisbury Basin is likely to be worked out.

PART II.

SECOND SUB-DIVISION

OF THE

FIRST BITUMINOUS COAL BASIN.

IN

SOMERSET COUNTY.

CHAPTER VI.

The Viaduct Anticlinal Axis in Somerset County, including also a description of the General Features of the Somerset Sub-Basin.

The eastern margin of the Somerset sub-basin is Negro Mountain, already described. The western boundary line of the same basin is the Viaduct axis, the *first* anticlinal sub-axis west of the Allegheny Mountain in Clearfield and Cambria counties, but which, in consequence of the interposition of Negro Mountain, becomes in Somerset county the *second* anticlinal sub-axis of the First Great Bituminous Basin.

To simplify matters, and to avoid any possible confusion, the name *Viaduct axis*, an eminently appropriate one, and accorded to it years ago by Messrs Hodge and Lesley, is retained throughout this report. By this name, moreover, it was described in the Report of Progress for Cambria County,* in which it was shown to be simply a continuation south-westward of the first anticlinal sub-axis of Clearfield county.†

After crossing the Conemaugh river seven miles south-east of Johnstown, at the Big Viaduct, from which locality its name is derived, this important anticlinal runs through a

*Report HH, Second Geological Survey of Pennsylvania.

†Report H, 1874.

high and uncultivated section of country, and reappears on Stony creek, which it crosses between Kring's mill and the mouth of Paint creek. In this interval, a distance of about ten miles on an air line, the axis leans south-westward along its strike, a fact demonstrated very clearly by accurate instrumental levels.

Thus the surface of the water at the Viaduct is 1,376 feet above mean tide, Atlantic ocean, while the surface of Stony creek at the Red Bridge is only 1,222 feet above the same datum, according to Mr. Peelor's levels; a difference of 154 feet.

The bed of the Conemaugh at the Viaduct, is at the base of Formation XI, (Mauch Chunk Red Shale,) whereas only a portion of this formation is above water level on Stony creek at the centre of the anticlinal. How much of XI has been uncovered at this latter place cannot, unfortunately, be definitely ascertained, owing to the total lack of exposures in the gap, the country being a wilderness and the surface of the high slopes covered deep with surface soil and debris.

But assuming in the absence of details that even the whole of Formation XI is above water level in the Stony Creek gap, and allowing 30 feet—a liberal allowance—for rise in the stream between the Red Bridge and the centre of the anticlinal, there still remains a difference of 124 feet between the Conemaugh and Stony creek levels, which can only be explained by a steady decline in the axis to the south-west along its strike or central line.

Moreover, the steady sinking has necessarily effected some important changes in the economic geology of the country, that can be best and most easily observed along the top of the high land which marks the run of the axis. At the Viaduct the Great Conglomerate forms the centre of the arch high above the water, thus thrusting even the lowermost beds of the Lower Productive coal series into the air at this point; but in following south-west along the even top of the axis, this great sandrock deposit (Formation XII, the Pottsville Conglomerate,) slowly sinks from sight, the coal beds of the Lower series coming in one by one to cross the arch, under cover, until at Stony creek the entire group seems to be represented in

the hill-tops, and the Pottsville Conglomerate shows only in the sides of the gap, where its outcrop is very plainly visible.

In this interval the general elevation of the axial ridge has diminished somewhat, which would tend to show that the actual fall of the anticlinal is in excess of 124 feet, a fact already hinted above; the true amount of fall is doubtless twice the latter figure, and perhaps even more.

Following the anticlinal still further southward into Somerset county a continued decline in the direction of the strike is noticeable. This brings the coals down from their high positions at the Red Bridge, and slowly but regularly they disappear in turn beneath the surface, the Lower Barren rocks piling up gradually on top of the axis until, in the vicinity of Davidsville, probably as much as 100 feet of these measures sweep across the anticlinal axis.

The disturbance along the axial line does not exceed in this locality a broad roll in the rocks, and the ridge representing the axis, though still distinguishable above the general surface, is no longer the marked feature in the topography of the country that it is north-east of the Red Bridge in Cambria county, and throughout the lower portion of Somerset county, especially south of the Castleman river, where it is of equal height with Laurel Hill and Negro Mountain; with which latter anticlinal it seems ultimately to coalesce after crossing the Maryland State line.

The Viaduct axis is at its lowest point in the latitude of Davidsville; thence it rises slowly but steadily southwestward, as will be shown presently from the levels.

In the vicinity of Davidsville the dip is very gentle northwest and south-east from the anticlinal, the incline of the axis to the south-west being fully as great at the mouth of Shade creek, as the normal dip to the south-east. This is very handsomely shown along Stony creek, between Faust's mills at the mouth of Shade Creek and the mouth of the Quemahoning, where the south-west incline ceases altogether, and the axis begins slowly to rise in the same direction. The course of Stony creek, in the short interval above indicated, is a northeasterly and south-westerly one, and Bed D, at Moyer's mine, a short distance above the mouth of Shade creek, is 130 feet by

barometer above the water, while at Eash's mine, one mile further up stream, the same coal, with the Ferriferous limestone, is found only 40 feet above the channel of Stony creek, a descent of 90 feet in one mile, or a 1° incline.

From this point south-west the run of the axis for over three miles is nearly parallel to the Quemahoning, its course keeping it within about a mile and a-half of the creek. It passes a short distance east of Stanton's mills, and shortly afterwards crosses the main branch of the Quemahoning creek at Morgan's woolen mill.

The axis at this place is unmistakable, the reverse dips being very decided. Moreover, the axis is plainly indicated by the topography, its course being here marked by a broad belt of high forest land. The top of the ridge is fully 2,000 feet above tide level, and bears only the lowest coals on its back.

As much as 100 feet of Formation XII is uncovered in the Quemahoning gap of the Viaduct axis. At Morgan's mills, the hills enclose the stream closely, rising about 300 feet above it, and including the Lower Freeport coal bed, which has been found on the rugged slope to the east of the mill.

In the absence of accurate levels throughout this section of country, those obtained by means of a reliable aneroid must be accepted for such purposes as they are required; and allowing a wide margin for possible error, these levels show that the top of the Conglomerate (XII) is 200 feet higher at Morgan's mills than it is close to the centre of the anticlinal east of Davidsville. This is a very significant fact, and shows that within the distance just named, the anticlinal is rising to the south-west at the rate of about 35 feet to the mile, an incline of about $\frac{1}{3}°$.

The close relationship existing between the condition of the surface, and the rise and fall of the Conglomerate, has already been shown.

An opportunity is afforded along the top of the axis, between Davidsville and Morgan's mills, to observe the directness of this relationship, and the gradual changes produced in the face of the country by the approach of the Conglomerate to the surface; while further south, along the top of the same axis, between Morgan's mills and the Castleman river, an additional

opportunity is afforded to notice the opposite effects, namely, those produced by a sinking anticlinal, carrying the Conglomerate downwards and burying it beneath a pile of softer rocks which furnish, by their disintegration, a smooth and kindly soil.

From Morgan's mills the axis is easily followed across the Jennerville turnpike, passing a short distance west of Mr. Zimman's house; it next runs through the upland of Somerset township, passing about one mile east of Sipesville and crosses the Somerset and Bedford pike close to the village of Lavansville, three miles west of the town of Somerset.

The axis is here plainly discernable as a well defined ridge of somewhat irregular outline, but rising neverthless prominently above the surrounding country, and reaching an elevation of at least 2,200 feet above the sea.

At Lavansville it is covered deep with Barren Measure rocks, and the Lower Productive coal beds are far below the surface, in which condition the axis continues nearly as far as the Castleman river, crossing this latter stream between Shoo Fly tunnel and Fort Hill.

Between Lavansville and the Castleman, the run of the axis is somewhat obscure, although it forms the high glade land on the top of which is situated the village of New Centreville, the anticlinal running probably underneath the village, or within a few hundred yards of it.

After crossing Middle creek, below New Centreville, the axis is next seen on the Castleman at the point above indicated; and it shows here not as one broad symmetrical arch, but consists rather of a series of irregular rolls, which seem to prevail with varying intensity from Pinkerton tunnel to Fort Hill station, where a decided north-west dip sets in and carries the rocks slowly downwards into the Johnstown-Confluence sub-basin.

Where the Castleman cuts through the Viaduct axis, the river flows in a deep gap, in which, at the centre of the anticlinal, the Great Conglomerate of No. XII, (Pottsville Conglomerate,) forms "a gigantic tessellated pavement for the river, from which rise cliffs upon each shore of thinly bedded sandstone, the bases of the lofty walls that support the cultivated upland*."

*Rogers' Final Report of 1858.

In this gap, the height of the top of the Conglomerate (XII) above tide level, at the centre of the anticlinal, can again be ascertained by means of the railroad levels. The central point of the axis cannot be precisely located on the Castleman, but it is certainly known within a half mile where the anticlinal crosses the river, the rocks being there horizontal, or nearly so.

At Shoo Fly tunnel, the top of the Piedmont sandstone (top of Formation XII) is 1,600 feet above mean tide, Atlantic ocean; this is about one-third of a mile east of the anticlinal arch, and allowing fifty feet for rise in the rocks between Shoo Fly and the arch, there is still a difference of 150 feet between this level and that obtained at Morgan's mills. It is perfectly obvious, not only from these levels, but from the condition of the top of the axis as well, that the anticlinal falls south-west along its strike from Morgan's mills; but it is thought that this fall continues only as far as New Centreville, from whence it is believed to rise slowly, but at the Castleman has not regained in elevation what was lost in running from Morgan's mills to New Centreville. This may be incorrect so far as it relates to the rise in the axis from New Centreville, but that there is a decline along the anticlinal between Morgan's and the Castleman, admits of no dispute.

Thus far the Viaduct axis runs nearly parallel to Laurel Hill; but in tracing it southward, across the Castleman, into Addison township, we soon find a startling change not only in the strike, but in the whole condition of the anticlinal. In a word we find it running nearly due south, and rising in that direction at the rate of about 130 feet to the mile. The effect of all this is apparent. With Negro Mountain maintaining its regular strike of S. 40° W., the change in the course of the Viaduct axis from S. 40° W. to due south is manifestly to cause the mountains to approach each other rapidly, and thus decrease the width of the enclosed synclinal trough.

At the Maryland line the two axes are only four miles apart, and the topography of Garrett county in Maryland, as broadly laid down in Walling's Atlas of this latter State, shows that the approach is further continued in Maryland, and that these two anticlinal axes (Viaduct and Negro Mountain) finally co-

alesce before reaching the Baltimore and Ohio Railroad. The point of junction is at Roman Nose, where the Allegheny Mountain also seems to join with the uniting anticlinals of Negro Mountain and the Viaduct or Winding Ridge, by which name the latter axis is known not only in Maryland, but also in Addison township of Somerset county.

Here this subject must be left for the present; the important and highly interesting question of the condition and structure of the First Great Bituminous Basin in Maryland and West Virginia—whether it exists there as one broad synclinal extending from the Allegheny Mountain to Laurel Hill, or whether these boundary lines have not in part been modified, and the basin intersected by subordinate anticlinal rolls, of which in Pennsylvania no perceptible trace remains, are subjects for future discussion.

This whole matter, however, replete with difficulties which are not lessened by the wildness of the region, is now receiving careful and thorough investigation from Prof. Stevenson.

The rapid rise of the Viaduct anticlinal along its central line, between the Castleman river and the Maryland border, has been referred to. The effect of this rise on the topography, geology and general condition of the country is necessarily very marked. In a space of eight miles, high hills are elevated into mountain ridges; the Barren Measures and Lower Productive coal rocks are pushed into the air not only along the mountain top, but over the whole valley, and a smooth glade land with easy rolling slopes in a high state of cultivation, is converted into a rugged wilderness rendered untillable by the outcrop of the Pottsville Conglomerate.

The Viaduct axis crosses White's creek near Waas' saw mill, about two miles south-east of the village of Listonville. The gap at this place is one of the handsomest in the Bituminous coal regions, being an almost straight cut westward through the ridge, the sides of which rise precipitously for nearly 800 feet into the air.

At the centre of the anticlinal in this gap a portion of Formation X is above water level, but Formations XI and XII make up the greater part of the gap. The anticlinal is entirely regular, and consists of one broad arch.

With the White's creek gap, close to the Maryland line, the description of the Viaduct axis in Pennsylvania ends. This axis has now been followed step by step across the several creeks and rivers from the Moshannon to the Mason and Dixon line, and throughout nearly all this distance has been shown to have a strike parallel to that of the Allegheny Mountain and Laurel Hill; and it has just been shown by a series of accurate levels how this Viaduct axis rolls along its central line in Somerset county, where unusual facilities for such study are offered in the numerous gaps of the antielinal, It may be useful to here tabulate these levels for more convenient reference, the top of the Conglomerate (XII) being a common horizon and used in each case:

Levels of top of XII along Viaduct Axis.

Conemaugh Viaduct, (Cambria county,) *above tide*....	1,800′
Stony creek, (Somerset county,).....	1,600′
Davidsville.....	1,500′
Morgan's mills, Quemahoning creek.....	1,800′
Castleman river, Fort Hill.....	1,650′
National road, Maryland line, top of Winding Ridge..	2,800′

It is manifest from the above description of the Viaduct antielinal, and from the description of Negro Mountain in Chapter I of this volume, that the Somerset sub-basin must diminish steadily in width going south-west through Somerset county.

At the Cambria county line the Negro Mountain axis has almost disappeared, and the limits of the basin are the same as in Cambria county, namely, from the Allegheny Mountain to the summit of the Viaduct axis; but as Negro Mountain slowly diverges from the Allegheny Mountain, it steadily encroaches on the Somerset sub-basin, reducing its width from ten miles at the Cambria line, to seven miles in the latitude of Somerset, and the rapid convergence south of the Castleman river, of the Negro Mountain and the Viaduct axis, (Winding ridge,) reduces this distance finally to about $3\frac{1}{2}$ miles, the width of basin at the Maryland State line. This fact is more clearly expressed on the Somerset county map, (Plate XVII,) on which the anticlinals are laid down.

The Somerset sub-basin derives its name from the county seat, which is situated near the centre of the Basin, and about midway between Cambria county and the Mason and Dixon

line. In addition, the basin contains the following towns and villages, of which, however, only the more important are here enumerated: Sealp Level, on the Cambria county line; Hooversville; Stanton's Mills; Stoystown; New Centreville, and Mineral Point. South of the Castleman river the basin is an almost unbroken wilderness, but eontains one small thrifty settlement, known as Peek's Corner, situated near the top of Negro Mountain, in the shales of Formation XI.

In the neighborhood of Stoystown, and elsewhere along the synelinal or central line of the Basin, a sufficient depth is attained to include a large amount of the Barren Measures overlying the Lower Produetive Coal Measures; but the Great Pittsburg bed, overlying the Barren Measures, is nowhere represented in the Basin. And the Barren Measure eoals, so far as these are included in the Basin, seem to possess no economic value. But of the Lower Produetive group there is a vast expanse above water level in this Somerset sub-basin, as well as a large amount below water level covered up by the Barren Measure rocks. The basin is, however, deeply furrowed by a number of large and important streams, which render aeeessible the greater part of the coal, ore, elay and limestone contained in the rocks eomposing the trough. Of these streams, the more important are the Castleman river, and Stony, Shade and Quemahoning creeks. These valleys, together with all the prineipal smaller valleys opening into them are deseribed in detail further on, and to these pages the reader is referred for particulars.

The Lower Produetive group may be said to streteh uninterruptedly from the Cambria eounty line to the Castleman river, arehing over the antielinals which eonfine the Basin, and spreading out into the troughs to the east and west. This eontinues with great regularity as far south as the Castleman river, where the entire group is present at the synelinal. But south of the river, the uplift of the whole trough has exposed it to mueh sharper denudation, and the eoal rocks have been swept away from nearly all of this portion of the basin. The Productive Coal Measures eross the river, but thin out rapidly to the south-west, and ultimately disappear entirely, leaving this

section almost destitute of fuel. At a number of points in this region, notably, at Peck's Corner, the carboniferous limestone in XI is quarried in considerable quantities, the coal necessary for calcining being brought from Salisbury at the western base of the Allegheny Mountain. Portions of this limestone deposit produce an excellent lime both for plastering and agricultural purposes, which is in high repute.

The Lower Productive coal rocks as developed in the Somerset sub-basin possess a few features especially worthy of note. The first of these in importance is the Hooversville iron ore, which so far as it has yet been investigated, gives every indication of existing in the form of a persistent band averaging perhaps two feet thick. Moreover, an analysis of this ore gave very favorable results, showing only a small amount of phosphorus and sulphur. The analysis is given in full on a succeeding page, together with a full description of the physical features of the bed, and its geological horizon.

The coals of this basin are mainly thin, but in places are of good quality and of sufficient thickness to be mined with profit along the avenues to market, if coal were actively in demand.

The Freeport sandstone along Coxes' creek and along the Castleman assumes unusual prominence. This is due to its abnormal thickness in the region indicated, and to the massiveness of the deposit. Its outcrop forms high cliffs of heavy compact sandstone, frequently conglomeritic, that might very readily be mistaken for the Pottsville Conglomerate of No. XII.

It is the Freeport sandstone outcropping on Kimberlin's run that forms the "Break Neck Rocks," a romantic spot in the vicinity of Somerset; and it is this same sandstone that has laid waste a large part of Coxe's creek valley, and extending down into the Castleman country, has in many places filled the bed of the river with large boulders, while the same material frequently covers the hill slopes and renders them untillable.

CHAPTER VII.

Stony Creek in the Somerset Sub-Basin.

In the Stony creek gap of the Viaduct anticlinal axis, the bed of the stream for a considerable distance is in the Pottsville Conglomerate of XII. At the Red Bridge, near the western end of this gap, the rock is seen just above the water, dipping north-west under the coal measures of the Johnstown Confluence sub-basin. At the centre of the anticlinal, in the neighborhood of Kring's mill, a portion of the Mauch Chunk Red Shale of Formation XI is probably above the bed of the creek, but this outcrop is concealed by surface soil and *debris*. Boulders of massive Conglomerate are here seen not only in the stream, but extending far up on the hillsides. Crossing the centre of the anticlinal axis, and ascending the bed of the creek into the Somerset sub-basin, the Conglomerate still remains above water level, the general course of the stream being for several miles nearly parallel to the strike of the rocks.

The developments are almost entirely confined to the top of the high land skirting the creek. The surface of the country has been furrowed by numerous small streams which have rendered the coal more accessible. Going south-west scarcely any developments whatever are met with in the valley of Stony Creek until the neighborhood of Faust's mills has been reached.

Faust's Mills.

This is at the mouth of Shade creek. The extended roll in the rocks, sweeping south-west, which occurs in this vicinity, has elsewhere been briefly noticed.

The Freeport coals occupy positions here high above the water level of Stony creek.

Meyers' Mine.—The coal and limestone of *Bed D* are seen at Meyer's Mine, about three quarters of a mile above the mouth of Shade creek.

The mine was opened on the western bank of Stony creek, a few hundred yards south-east of Mr. Meyers' house.

The coal bed is 130 *feet by barometer* above the creek, which here flows over heavy massive sandstone. The hillside on which the coal has been opened is steep, and in the interval between the mine and the creek, no well defined coal bench shows, but indications of coal are thought to have been detected about 50 feet above the water.

Above the mine there are two benches at intervals which suggest the Freeport group. These benches were traced south-westward along the hillside, and were connected with the developments on Mr. Eash's property described further on.

In Meyers' mine, a gentle incline of the coal to the south-east is perceptible, the main gangway being driven north-west and rising slightly in that direction. But the *sinking to the south-west*, though abnormal, is far deeper and decidedly more important.

The coal measured as follows in the mine:

Sandstone, massive.		
Black slate	3′ 0″	
Coal	3′ 9″	3′ 9″
Slate	1′ 0″	
Limestone	5′ 0″	

The coal is hard, compact, and mines out in blocks.

The limestone produces a reddish lime indicative of the iron contained in it.

Between this mine, and the developments near the Bridge, about one mile west-south-west, no openings have been made, but the bed is easily traced on its downward course along the hillside, the interval between the coal and the creek gradually decreasing.

In the vicinity of the bridge, the bed is worked on both sides of the stream. The coal shows in one solid breast 3½ feet thick. The thin band of slate, almost invariably present near the bottom of this bed, has not yet made its appearance at Stoystown. But in going south-west from Stoystown this slate band grows steadily thicker, swelling out to a foot in thickness along the Castleman, and becoming a regular and recognizable feature of the bed.

Mr. William Trevorrow has opened up this coal on the eastern bank of Stony creek, about two miles south-west of Davidsville. The mine is, by barometer, forty feet above the creek level at the Bridge. The coal is here provided with good cover, and as far as the gangway had been driven, the bed remained entirely regular.

The work in Trevorrow's mine has been skillfully done, and the drift presents a handsome appearance.

Near the mouth of the opening a large kiln has recently been erected, in which it is proposed to calcine the limestone underlying the coal.

Average specimens of the coal and limestone were forwarded to Harrisburg and there yielded very satisfactory results on analysis.

The coal contains little moisture and only a small amount of sulphur, (less than $\frac{3}{4}$ of one per cent.) The ash is due to minute seams of slate running through the coal; these knife edges of slate cannot be got rid of even by the most careful mining, and the percentage of ash cannot be reduced. But the amount of earthy matter in the coal is far from large, and the bed here yields a firm, compact and clean coal that will bear handling and transportation, and is admirably adapted for steam generating purposes, or for rolling mill use. The analysis is as follows (D. M'Creath):

"Water at 225°	.670
Volatile matter	14.530
Fixed carbon	74.800
Sulphur	.635
Ash	9.365
	100.000

Coke per cent, 84.800; color of ash, white.

The coal has a dull lustre, generally, but has seams of bright crystalline coal running through it; it is unusually compact, and seems usually free from pyrites."

The analysis of the limestone, on which the coal rests, is equally good. It shows a great preponderance of carbonate of lime; very little carbonate of magnesia (is therefore not dolomitic); only a small amount of alumina, and not enough carbonate of iron to interfere with its calcining easily. It will therefore produce in the kiln a good strong lime, well adapted for fertilizing purposes.

The analysis by Mr. A. S. M'Creath, shows the following constituents, and the proportions they bear to one another:

"Carbonate of lime	90.544
Carbonate of magnesia	2.134
Carbonate of iron	1.503
Alumina	.261
Sulphur	.464
Phosphorus	.013
Insoluble residue	3.850

The limestone is hard, exceedingly brittle, with a conchoidal fracture, and of a bluish gray color."

Eash Mine.—The same coal bed is developed on the opposite side of Stony creek by Mr. Eash, in whose mine a fair measurement of the coal was obtained as follows:

Fig. 40.

This bottom slate does not exceed a few inches in thickness, and is directly underlaid by the stratum of ferriferous limestone.

Fifty feet above Eash's mine, a second seam of coal outcrops, said to be underlaid by 3 feet of impure limestone. This is *bed D'*; and about 70 feet still higher, a well defined coal terrace shows on the same hill. This bench is reported to be coal bearing, having once been opened, but the thickness of the bed is unknown. *The Freeport group of coals* is therefore present at this point, above water level, and occupies a favorable position in the hills for easy mining.

A north-east rise in the rocks is plainly felt in Eash's mine, and the coal cannot be worked on a south-west course.

Ascending the stream bed from this point, the Negro Mountain anticlinal is slowly approached. From the bridge the rocks rise very gently south-westward towards this anticlinal, the rise being about equivalent to the slope of the creek bed. Under ordinary circumstances the rocks would therefore remain the same, or nearly so, in ascending the creek from the bridge for a few miles. This, however, is not the case. Lower rocks than those above water level in the vicinity of the bridge rise above the creek as Hooversville is approached.

Swank Mine.—Precisely the same coal bed that is mined by Messrs. Trevorrow and Eash close to the water level, near the mouth of the Quemahoning, is high above Stony creek at Swank's mine, one-half mile below Hooversville. In appearance, structure, thickness and general character the bed has undergone little change, *but a thin though persistent band of slate is noticed for the first time in Mr. Swank's mine.*

In order to show this more clearly, the following measurement of the bed as exhibited in Mr. Swank's mine is reproduced:

Sandstone roof.			
Coal, hard	3′	0″	4′ 0½″
Slate	0′	½″	
Coal	1′	0″	
Floor not seen.			

By barometrical measurement the opening is 112 feet above Stony creek.

Between this point and Hooversville the coal has been opened at several places along its line of outcrop, the bed yielding in every instance full three feet of hard bright coal, underlaid by its usual attendant band of limestone.

A mass of sandstone, 35 feet in thickness, outcrops above the coal, forming an abrupt cliff which ranges along the hill slope passing behind the town of Hooversville. This same sandstone again appears as a bold cliff at Lohr's quarry, a short distance above Hooversville.

Hooversville.

Stony creek, at Hooversville, flows over the massive Pottsville Conglomerate of XII. The lofty hills which shut in the village from the east and west, are therefore coal bearing. The lowest coal bed comes to daylight in the bank of the creek, just below the bridge at Hooversville. This seam measures full three feet thick; its outcrop was once fairly opened up, and an attempt was made to mine it, but the bed carries such large quantities of sulphur that the coal was condemned as worthless, and the mine abandoned.

The next higher seam in the series is worked on Fallen Timber run, to the south-west of Hooversville, by *Mr. G. W. Clark*; it overlies the first by about 50 feet.

Besides these, three other beds of coal are said to have been opened by Clark in the hill above his mine.

Hooversville Iron Ore.—The carbonate iron ore already mentioned in a previous page as occurring between coal beds A and B, has been opened at its outcrop, on Mr. Clark's land, a few feet above Fallen Timber run.

The deposit exists as two bands, separated by a few inches of shale. So far as followed these bands have proved persistent, measuring in all nearly 2 feet thick.

The ore oxidises rapidly at the outcrop, becoming shelly and changing in color to a Spanish brown.

An average specimen from this ore deposit was forwarded by Mr. Clark to the State Laboratory at Harrisburg, yielding on analysis as follows (D. M'Creath):

Protoxide of iron	44.357
Sesquioxide of iron	2.857
Bisulphide of iron	.247
Protoxide of manganese	.873
Alumina	3.220
Lime	1.210
Magnesia	1.690
Phosphoric acid	.338
Sulphuric acid	.040
Carbonic acid	29.860
Water	.990
Carbonaceous matter	.930
Insoluble residue	12.403
	99.015
Iron	36.500
Manganese	.677
Sulphur	.148
Phosphorus	.148

Carbonate ore; compact, minutely crystalline; bluish gray."

This analysis is eminently satisfactory, and establishes, as far as a single analysis can, the excellent character of this ore deposit. It shows further that the ore is a true carbonate, fully as good as that so extensively worked by the Cambria Iron Company at Johnstown. The presence of a small amount of manganese in this Hooversville ore will also be noticed, and it should be remembered that manganese also occurs in small quantities in the iron ore deposit at Johnstown.

But the small amount of phosphorus in the Hooversville ore (less than one-half of one per cent to the ton of metal), claims especial attention. The percentage of sulphur is small, and al-

together the ore may justly be regarded as the most valuable yet discovered in Somerset county.

The iron ore found in the hill above the Upper Freeport coal, lies imbedded in a mass of ferruginous shales several feet thick.

This ore has never been properly opened and examined, so that no statement can be offered respecting its form of deposit or character.

The horizon of the ore is easily traced along the brow of the hill by the fragments of shelly limonite which lie scattered over the surface, and the deposit may prove of value. But the same ore outcrops elsewhere on Stony creek, as for example, at Lohr's, at which place it was opened and no encouraging results were reached.

Clark Mine.—The Clark mine, on Fallen Timber run, is about one-half mile above the junction of the latter stream with Stony creek.

The main gangway is driven to the south-east, the rocks rising in that direction at an angle of between 3° and 4°.

At the face of the mine nearly four feet of coal show in one compact bench, without persistent partings of slate, as follows:

Black slate.

Fig. 41.

Coal, slaty and poor	0′ 6″	5′ 8″
Coal, good	from 3′ 6″ to 3′ 8″	
Slate	from 0′ 1″ to 0′ 3″	
Coal	1′ 3″	

The upper bench alone is mined, and produces an excellent quality of coal. A band of slate, averaging about 3 inches in thickness, ranges through the lower coal with great persistency, and injures the value of this portion of the bed.

The coal mined is soft and bright, and produces a fair quality of coke, even when roughly coked in open heaps, as it comes from the mine.

A specimen of the coal was forwarded to Harrisburg and there yielded on analysis (D. M'Creath):

"Water at 225°	.770
Volatile matter	15.870
Fixed carbon	76.925
Sulphur	.690
Ash	5.745
	100.000

Coke per cent, 83.360; color of ash, gray.

The coal is bright, very tender, showing small specks of iron pyrites and efflorescence of sulphate of iron."

From one-half to three-fourths of a mile further up the run a handsome exposure of the rocks, both over and underlying Clark's coal, occurs in a steep hillside.

Vertical Section at Hooversville.

Fig. 42 (Page Plate VIII) is a rough section of the measures as developed in the neighborhood of Hooversville. All of the rocks of the Lower Productive series are here represented, from the Mahoning sandstone to the massive Pottsville Conglomerate. The benches of the several coal beds enclosed in these rocks terrace the hillsides, and follow the creek and its little tributaries with great persistency and regularity in all their curves and turns.

The section reads as follows:

Coal			0′ 8″
Interval			10′ 0″
Ferruginous shales, holding balls of iron ore			5′ 0″
Interval; surface covered with lumps of coarse grained sandstone			48′ 0″
Coal, reported, E (?) .			
Interval; concealed measures			52′ 0″
Coal, reported, D′ (?).			
Interval			48′ 0″
Coal, reported, D. (?)			
Interval			36′ 0″
Black slates, with kidney ore			4′ 0″
Coal smut, showing			3′ 9′
Impure fire clay (?)			6′ 0″
Sandstone			1′ 3″
Slates and shales			8′ 0″
Black slates			1′ 0″
Coal smut			0′ 6″
Black slate			1′ 0′
Sandy, ferruginous shales, carrying ore balls			4′ 6″
Sandstone			1′ 8′
Slates and shales; iron stained			12′ 0″
Black slate			15′ 0′
Coal	Bed B, 6′ $3\frac{3}{4}$′		4′ 6″
Slate			0′ $\frac{1}{4}$″
Coal			0′ 6′
Slate			0′ 3″
Coal			1′ 0″
Slate and coal			1′ 0′
Black slates			2′ 6′
Fire clay, good			3′ 2″

SECOND GEOLOGICAL SURVEY OF PA

1875

Fig. 42.

HOOVERSVILLE.

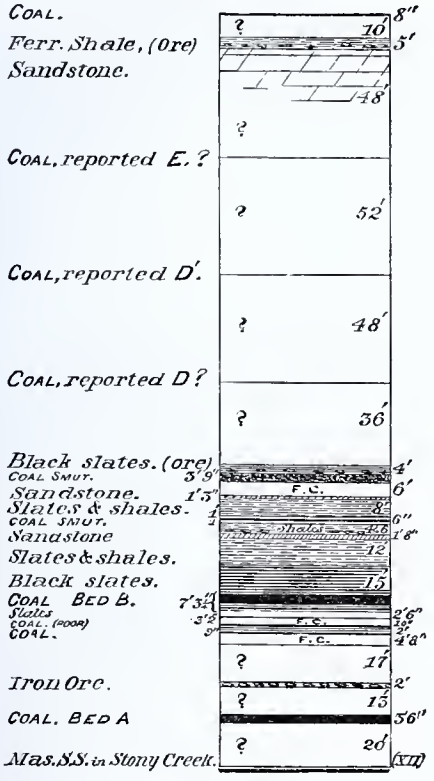
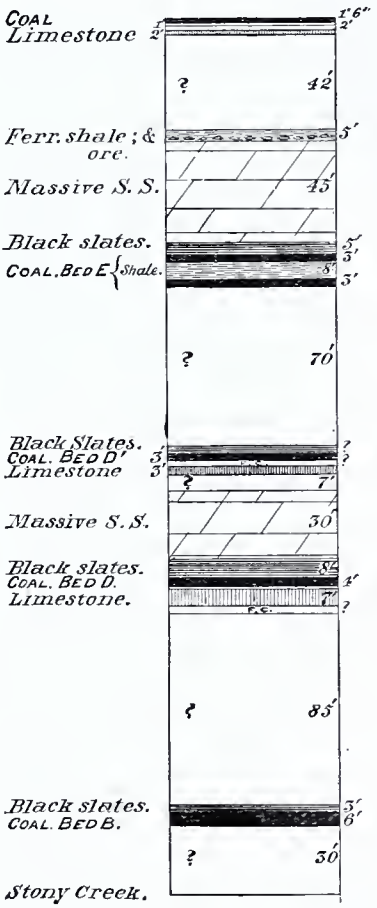


Fig. 45.

STOYSTOWN.



O. B. H.

Coal, poor	0′ 10″
Black slates	2′ 0″
Coal	0′ 9″
Fire clay, impure	4′ 8″
Interval	17′ 0″
Iron ore	2′ 0″
Interval	13′ 0″
Coal Bed A	3′ 6″
Interval	20′ 0″
Massive Sandstone, XII, in Stony creek.	
	335′ 0″

Stony Creek.

On Jonathan Lohr's farm, *between Hooversville and Stoystown*, coal bed D, underlaid by the stratum of ferriferous limestone, (characteristic of this seam, particularly in the Somerset sub-basin of Somerset county,) is at an elevation above tide water of 1,755 feet, having come down nearly 200 feet from its level at Stoystown. This shows that in descending Stony creek, from where this stream gaps Negro Mountain, the incline of the measures to the north-west is very decided, certainly as far as Hooversville. Thence the stream crosses the basin at a much sharper angle, and the measures are *observed to flatten*, but soon begin to rise out to the north-west in obedience to the *Viaduct anticlinal sub-axis.*

It has already been stated that at the mouth of the Quemahoning a sharp rise in the rocks to the north-east is plainly perceptible along Stony creek, extending below Faust's mills near the mouth of Shade creek. The normal rise to the north-west is also noticeable, but it is subdued and secondary to the sweep to the north-east.

Lohr's Mine.—On Jonathan Lohr's property two beds of coal have been opened on a steep hillside rising to the west of Stony creek. These coals are separated by about 90 feet of measures and represent *beds B and D.*

The lower seam is exposed about 25 feet above the bed of creek. The opening has not yet been driven in beyond the soft coal of the outcrop, and a fair estimate cannot be formed (1876) of the quality or thickness of the bed. Full 5 feet of coal, however, show. Moreover, the bed seemed parted, in two places, as at Sprucetown, by thin bands of slate.

The upper seam is mined in conjunction with its underlying band of limestone, and yields over 3 feet of good hard coal.

The bed is parted near the floor by a thin layer of slate, which remains persistent throughout the mine.

The limestone is separated from the coal by about 6 inches of black slate; the former is here quarried quite extensively and burned near by. An apparently impure lime is produced from it, which nevertheless gives satisfaction among the farmers in the neighborhood, who use it in fertilizing the soil. Imbedded in the limestone occur occasional wedges or lenticular masses of soft yellow clay, admitting of a high polish, receiving easily an impression from the finger nail, and having a smooth, greasy feeling in the fingers.

A specimen of the clay was analysed by Mr. D. M'Creath, of the Geological Survey, with the following results:

"Silica	45.730
Alumina	29.693
Sesquioxide of iron	6.857
Lime	.440
Magnesia	1.005
Water	12.860
Alkalies (by deduction)	3.415
	100.000"

A bluff of massive sandstone, 30 feet high, shows directly over Lohr's mine; above this the hill rises and contains all the measures given in the Stoystown section (see Fig. 45, Page Plate VIII).

The main gangway of Lohr's mine is driven north-west and rises somewhat, the water draining to the south-east. This rise is scarcely due to a subordinate roll of the rocks, and the synclinal axis of the basin must therefore be east of Lohr's quarry.

Berkey Mine.—About 2½ miles above Hooversville a bed of coal shows on D. Berkey's farm. The opening is now completely shut, but 3 feet of coal were seen at the mouth of the mine, with coal still in the bottom. Mr. Berkey represents it as a "4-foot bed," and it is possibly the Upper Freeport coal that has here been opened. A band of limestone, about 3 feet thick, outcrops between 80 and 90 feet higher in the hill.

This limestone is quite pure, and has already been quarried and burned by Berkey. It is in all about 2 feet thick, overlaid by black slates, above which is a thin seam of coal, measuring from 1 foot to 18 inches in thickness.

The iron ore in the vertical section outcrops some distance further down Stony creek, at Lohr's limestone quarry, and has not been traced as far as Berkey's. Berkey's mine is about 200 feet above Stony creek, and several well marked coal benches show on the hillside between the mine and the creek, but they have never been examined and nothing is known of their contents.

Stoystown.

At Stoystown the Freeport coals, descending from the east, outcrop on both sides of Stony creek.

It has already been shown that these beds are visible along Well's creek nearly all the way from its head waters to its mouth. But Stony creek, flowing for a short distance northwest, gets deeper into the basin, and just south of Stoystown the Lower Freeport bed (D) is found near water level.

Another sharp turn, however, in the creek, by which its course is shifted to the north-east for full one mile, has left the Freeport coals far up in the hills, and exposed a subjacent workable seam.

Stoystown is situated on a high hill to the west of Stony creek, at an elevation (by barometrical measurements) of 2,130 feet above tide water at Philadelphia.

Westward and north-westward from Stoystown the country sinks very slightly, and a broad sheet of the Barren Measures spreads over the hilltops, concealing over the greater part of Quemahoning township all the Lower Productive coals, excepting where they are exposed in the narrow trough-shaped valleys, hollowed out by the waters of Higgins' run and along the Quemahoning creek.

A lack of exposures and reliable coal openings renders it difficult to draw precisely the line of the synclinal axis through this portion of the basin; but it probably passes about $1\frac{1}{2}$ miles west of Stoystown.

The anticlinal axis crosses the Stoystown and Jennerville turnpike, a short distance west of D. Bowman's house.

Thus, while the basin continues sufficiently deep to hold large belts of coal, the beds are at such a depth below the general surface as will preclude the possibility of their being

worked by drift, above water level, excepting along the line of the principal streams, where the erosion has been great.

Subsequently the course of Stony creek changes again to the north-west, cutting the basin transversely, and offering good opportunities for easy mining.

Specht's Mine.—The lowest coal bed above water level in the vicinity of Stoystown is mined by David Specht, close to the border of Stony creek, near the bridge just below Sprucetown. The bed here opened is the second bed of the Lower Productive series, or bed B; its existence above water level at this point has been known for many years, and it was recognized as bed B during the time of the First Geological Survey (see Final Report, Vol. II, p. 656). It underlies the openings on bed D to the south-west by about 100 feet, which is the usual distance between these two beds throughout this whole country.

Specht's mine, 30 feet above water level, starts into a distinct bench on the eastern bank of the creek. The main gangway is driven south-south-east, and rises, the water draining off easily.

The bed is divided into three benches of coal separated by thin bands of a hard fire-clay shale, as follows:

Fig. 43.

Black slate.			
Coal	2′ 6″		
Parting	0′ 3″		
Coal	1′ 5″	6′	6′
Parting	0′ 6″		
Coal	1′ 10″		
Fire-clay.			

The upper bench yields a tolerably pure coal, of columnar structure, which crumbles fine in mining, and possesses a bright lustre; the central bench produces a much harder coal than that above, and decidedly inferior in quality to it, carrying obviously a greater amount of sulphate of iron. Rolls and irregularities in the fire-clay shale underlying this bench cause it to vary in thickness from a few inches to 1½ feet, these changes sometimes occurring in a few yards of space.

The coal in the lowest bench is very impure and almost worthless.

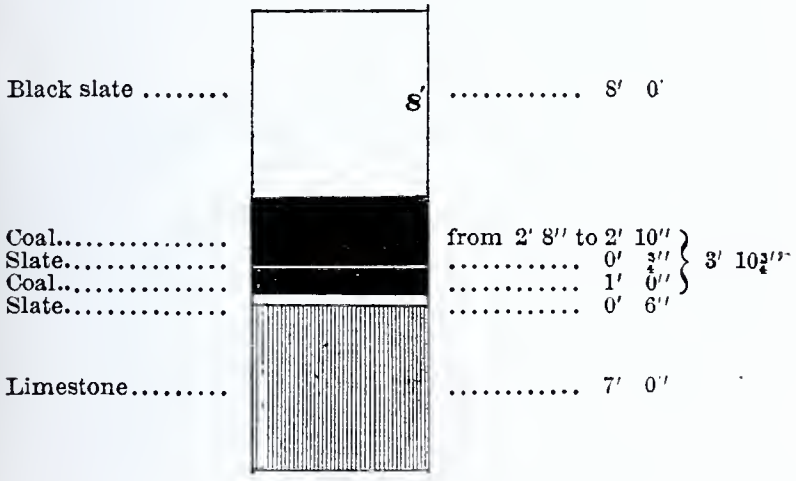
The rocks are here dipping to the north-west, and the bed disappears under the high land to the west of Stony creek.

F. Kimmel's mine on bed D, to the south of Specht, had only been very recently opened, (November, 1875,) and was not in beyond the soft coal of the outcrop.

W. Wilt Mine.—On the opposite side of Stony creek, about one half of a mile due west of Kimmel's, Wm. Wilt is working the same bed, 150 feet lower in the hills. The mine has abundance of cover over it, and the coal is hard and firm, mining out in blocks.

Eight feet of black slates show at the mouth of the mine above the coal. The bed is here underlaid by a stratum of impure limestone, seven feet thick, separated from the coal by from 6 to 8 inches of black slate. The following section of the coal shows at the face of Wilt's mine:

Fig. 44.



The upper bench of coal is compact and crystallized in horizontal layers; it carries iron pyrites chiefly in the form of large balls, some of which attain at times an unusual size. The coal, however, is represented as good, and large quantities of it are used about Stoystown. A specimen was forwarded to the State Laboratory, and yielded there on analysis (A. S. M'Creath):

"Water at 225°	.600
Volatile matter	15.415
Fixed carbon	70.632
Sulphur	1.748
Ash	11.605
	100.000

Coke per cent, 83.985; color of ash, gray.

The coal is shining, tender, and seamed with charcoal and iron pyrites."

The lower bench of the bed is slaty and poor.

The limestone is quarried and burned in open heaps in front of the mine. An impure grayish lime is produced from it, unfit for plastering, but represented as a strong fertilizer.

A specimen of the limestone was forwarded by Mr. Wilt to the State Laboratory, and the analysis there made of it resulted as follows (A. S. M'Creath):

"Carbonate of lime	88.139
Carbonate of magnesia	1.854
Carbonate of iron	1.798
Alumina	.340
Sulphur	.457
Phosphorus	.023
Insoluble residue	5.640

Compact, minutely crystalline and of a bluish-black color."

Wilt's mine is 60 feet above Stony creek.

A second seam of coal shows in the hill 50 feet above Wilt's mine. It was once opened up on this property and was found to measure 3 feet, underlaid by a stratum of impure limestone, also three feet in thickness. From 75 to 80 feet still higher in the hill a distinct and well rounded coal terrace occurs, which probably marks the outcrop of the Upper Freeport coal.

This coal is now nowhere worked in the vicinity of Stoystown. It was mined, however, some years ago on Oven's run, 2 miles north-east of Stoystown, and is described in the Final Report of 1858 (Vol. II, p. 656) as "divided into two beds, 8 feet apart, and each of them 3 feet thick."

Beaver Dam Creek.

J. Kimmel Mine.—The Lower Freeport coal has been again opened on Beaver Dam creek, by J. Kimmel, a short distance west of Wilt's mine. The difference of 75 feet in level between the two mines is explained by the very decided dip of the rocks to the north-west. Kimmel's mine is about 25 feet above the water level of Beaver Dam creek, and the coal measures:

Roof, black slate.		
Coal	2′ 10″	3′ 4¾″
Slate	0′ ¾″	
Coal	0′ 6″	
Slate	0′ 6″	
Limestone.		

The upper bench of coal alone is mined, the lower bench being allowed to remain in the floor.

The coal taken out is moderately free from slate, but shows considerable iron pyrites. It is compact and hard, and mines out in lumps.

The limestone underneath the coal is about the same as at Wilt's mine, page 127 above.

The bench of *bcd D'* shows plainly in the hill above.

Stoystown Vertical Section.

Fig. 45 (Page Plate VIII) gives the distances between the several coal beds above water level in the neighborhood of Stoystown. It is partly taken from Rogers' Final Report*.

Coal	1′	6″
Slate	1′	0″
Impure fire-clay	2′	0″
Limestone, good	2′	0″
Interval	42′	0″
Ferruginous shales, with balls of iron ore	5′	0″
Sandstone, massive	45′	0″
Black slates,	5′	0″
Coal.... }	3′	0″
Shale... } Bed E	8′	0″
Coal.... }	3′	0″
Interval	70′	0″
Black slates	?	
Coal, bed D′	3′	0″
Fire-clay	2′	0″ (?)
Limestone (?)	3′	0″
Unknown	7′	0″
Sandstone, massive, forming cliff	30′	0″
Black slates	8′	0″
Coal, bed D	4′	0″
Black slate	0′	6″
Limestone	7′	0″
Fire-clay	?	
Interval	85′	0″
Black slates	3′	0″
Coal, bed B	6′	0′
Interval	30′	0″
Stony creek.		
	376′	0″

Barnhardt Mine.—On J. A. Barnhardt's farm, about one mile above the mouth of Wells creek, a bed of coal is opened 70 feet above the waters of Wells creek, at Schäfer's saw mill. It shows thus:

*Final Report of 1858, Vol. II, p. 656.

Fig. 46.

This coal was estimated to overlie Reitz's limestone, described further on, by as much as 100 feet, and probably more, and is therefore adjudged to be the Upper Freeport coal, or *bed E* of the Lower Productive series.

A thin seam of coal is said to outcrop in the bed of Wells creek at Schäfer's saw mill. This coal, however, was not visible, nor was the "4-foot" bed underlaid by limestone, reported as outcropping further down the creek.

Barnhardt's coal is of excellent quality, soft, friable, easily mined and shows very little sulphur as iron pyrites.

The mine has already suffered considerably from numerous horsebacks, the troubles arising principally from the floor. The coal is much squeezed and pinched whenever such horsebacks occur, but thus far no more serious troubles have been experienced.

The above section of the coal represents the bed at its normal thickness.

Reitz Mine.—Near the headwaters of Wells creek, an affluent of Stony creek, a band of limestone, nearly seven feet thick, is worked on the Geo. Reitz's property, in the vicinity of Friedensburg. A bed of coal, measuring full 3½ feet in thickness, overlies the limestone by about 1 foot, the interval being made up of black slates and bony coal. The slate, however, is often absent altogether, and the coal rests directly on the limestone stratum. Underneath the limestone, balls of carbonate iron ore are found embedded in fire-clay shale. The base of the limestone is only a few feet above the waters of Wells creek.

The limestone is moderately pure and produces a grayish lime. Specimens of the stone were forwarded to the Laboratory at Harrisburg, and yielded as follows on analysis (D. M'Creath):

"Carbonate of lime	86.778
Carbonate of magnesia	2.908
Carbonate of iron (with a little alumina)	2.972
Sulphur	.166

Phosphorus	.037
Insoluble residue	6.040
	98.901

Compact, bluish-gray."

A second bed of coal outcrops 50 feet higher in the hill. This bed is worked by Mr. Reitz, and yields about 2½ feet of coal. The coal is not of a superior quality, being much intermixed with slate, but serves very well to calcine the limestone, which is done in large quantities in a kiln near by.

A specimen of the coal mined by Mr. Reitz was analysed at Harrisburg with the following results (D. M'Creath):

"Water at 225°	.940
Volatile matter	19.060
Fixed carbon	70.659
Sulphur	1.291
Ash	8.050
	100.000

Coke per cent, 80.000; color of ash, red.

The coal is exceedingly tender, and is seamed with mineral charcoal and iron pyrites."

Still another seam of coal occurs in the hill from 70 to 80 feet above the last, and has been opened on *Mowry's land*, to the south-east of Reitz's limestone quarry, but the opening is now shut and no measurement of the coal could be obtained. It is represented as a "four foot" seam, and is further said to have yielded a good strong coal.

This is the Freeport group of coals, small, but nevertheless of workable size, and all above water level. It will further be noticed that the distances between the beds correspond very closely with those obtained in the First and Second sub-basins in Cambria county, although a slight thickening of the measures is perceptible.

These coals have never been developed to any extent in this section of country, but it is probably safe to assume that they will compare favorably with the same beds opened and worked around Stoystown and Hooversville further north.

Well's Creek Iron Ore.—Referring to the iron ore on Wells creek, Rogers' Final Report* uses the following language in connection with the region now under discussion:

"A locality important for its iron ore is on Wells creek, 5½

*Final Report of 1858, pp. 656 and 657.

miles north-east of Somerset. Here a layer of limestone occurs in the bed of the creek, resting on a blue sandstone, which forms the bottom of the channel. The limestone is said to be in all 6 feet thick, though only 2 feet are exposed. A coal bed, showing a promising outcrop, appears a few feet above the limestone, and indications of other coal seams present themselves farther up the hill. One of these upper beds has been worked. At the top of the hill, nearly 300 (?) feet above the stream, in a sterile tract of a few acres, many pieces of a very rich red iron ore have been met with, but the quantity remains unknown. This spot deserves examination. Should the ore be abundant, its value would be enhanced by its proximity to another deposit of ore on Stony creek (at the 'Silver Diggings') with which it might be worked."

The north-west dip of the measures carries the coals under the high land rising to the west of Wells' creek, and they are not again seen in Somerset township until they have crossed the arch of the Viaduct anticlinal sub-axis, and have reached the valley of the Quemahoning in the Johnstown sub-basin.

This would give an enormous unbroken expanse of coal to this one township, but unfortunately at such a depth beneath the surface as to render its presence there at present of but little practical importance.

Raman Mine.—One and one-half miles east of Reitz's quarry, and high up on the western slope of Negro Mountain, a bed of coal is mined on Mr. Raman's farm. The mine starts into a high bench, and is 370 feet (by barometer) above Wells' creek at Reitz's mine. The coal continues to rise slowly with the hill to the south-east, until it finally comes out to daylight on the top of Negro Mountain.

The bed yields over $2\frac{1}{2}$ feet of coal, as follows:

Black slate.

Fig. 47.

Coal..... ..... 2' 10"

Soft clay in floor.

The bed is parted near the centre by a thin band of slate three-fourths of an inch thick.

The coal is of a rich, lustrous appearance; it carries only a trifling amount of iron pyrites, and is preferred by the blacksmiths to any other coal mined in the neighborhood.

CHAPTER VIII.

Paint, Shade and Quemahoning Creeks.

Ascending Paint creek from its junction with Stony creek near Kring's mill, a massive, quartzose, homogeneous Conglomerate, representing Formation XII, is marked not only in the bed of the stream, but forms abrupt cliffs which line the water's edge on either side. High hills border the stream and contain valuable beds of coal.

Paint Creek in the Somerset Sub-basin.

At the confluence of Paint creek and Little Paint creek, near *Scalp Level*, bluffs of massive Conglomerate rise vertically above the water, which here for a short distance rushes through a narrow gorge, and by a rapid succession of short leaps over ledges of rocks, produces a series of picturesque cascades and falls.

It is at this point that a thin seam of coal from 14 to 18 inches thick outcrops just above the water. Where exposed, near the saw mill, the coal is enclosed by walls of massive sandrock, but where regularly developed, further down the creek, the coal rests upon a thin stratum of sandy fire clay. This small coal seam, 50 feet below Bed A (exposed at the dam on Little Paint creek) is frequently present in the Conglomerate.

Paint Creek Iron Ore.—It is claimed that iron ore has been discovered in this vicinity along the line of Paint creek, but its outcrop is now wholly concealed.

Rogers' Final Report of 1858 refers to the ore of this locality in the following terms (Vol. II, page 655):

"At the forks of Paint creek, as the section exhibits, there is at the saw mill an abundance of good ore 2 feet thick, partly 'rock ore,' or continuous strata, and partly very continuous ball ore, within a space of 8 feet. Besides these there are

beds of large nodules in the 5 feet sandstone roof, and a very good ore in the 4½ feet shale below. The lower band farther down the creek affords masses of many pounds' weight lying almost loose in the bed of the creek; but it cannot be mined because it seems to be included between hard massive sandstones."

Paint Creek Vertical Section.

The following section, (Fig. 48, Page Plate IX,) showing the ore and the rocks in which it is enclosed, is also taken from the Final Report:

Sandstone	5′	0″
Iron ore	1′	0″
Sandstone	3′	0″
Ore	0′	5″
Black slates	2′	0″
Ore, separated by thin bands of slate	0′	7″
Sandstone	6′	0″
Shales, with balls of ore	4′	6″
Black slate	2′	6″
Coal	3′	0″+
Fire-clay		?
Sandstone	40′	0″
Coal		?
Sandstone	40′	0″
Ore	0′	7″
Shales	1′	0″
Sandstone, with ore balls	30′	0″
Slate and shales	5′	0″
Sandstone, massive.		
	144′	7″

The benches of all the principal coal beds occurring in the Lower Productive coal measures show handsomely *on D. Weaver's hill*, just north of the Cambria county line. The distances between these benches were measured barometrically, and a complete section of them has been given on a previous page.

Two beds of coal, by barometer 30 feet apart, outcrop on *J. Weaver's farm*, near the Lutheran church, about three-fourths of a mile south-west of Scalp Level.

Both seams are underlaid by limestone, the upper band being about three feet thick and yielding a good limestone, a small amount of which has been quarried and burned by Mr. Weaver.

The lower limestone is ferriferous, and is not worked. The analysis of this limestone shows it to contain at this place a considerable amount of iron existing as a carbonate. The

analysis forms one of a series, made in order to show the changes this limestone deposit undergoes throughout Somerset county. It reads as follows (D. M'Creath):

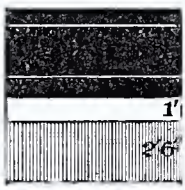
"Carbonate of lime	50.160
Carbonate of magnesia	18.494
Carbonate of iron	11.600
Sulphur	.153
Phosphorus	.120
Insoluble residue	13.360

Ferriferous limestone, hard and compact; thin crust of hematite; shows a few spots of pyrites; color, bluish gray."

Weaver Mine, Bed D'.—The upper seam of coal is thin, unimportant, and parted by two thin bands of slate. Moreover, the coal produced from it is impure and of inferior quality.

The following section of the bed, showing also the underlying limestone, was obtained at the quarry:

Fig. 49.



Sandstone.		
Coal	0′ 6″	3′ 6½″
Slate	0′ 2″	
Coal	2′ 0″	
Slate	0′ ½″	
Coal	0′ 10′	
Black slate	1 0′	
Limestone	2′ 6″+	

Weaver Mine, Bed D.—The subjacent coal bed has been mined on Mr. Weaver's property for a number of years.

The mine has been somewhat troubled with horsebacks, reducing in places the thickness of the coal to about one-half its regular size. The irregularities, however, have neither been of an obstinate nature, nor of a frequent occurrence.

The bed is unequally divided by a thick parting of slate which usually forms the roof of the mine, the upper bench of coal being pronounced worthless.

The lower bench yields nearly four feet of bright hard coal of horizontal crystallization. It breaks up into rough blocks in mining, and will bear transportation. The following section gives the entire thickness of the bed:

Black slate.		
Coal, bony and worthless	2′ 0″	7′ 1″
Slate parting	1′ 1″	
Coal	from 3′ 10″ to 4′ 0″	
Floor slate.		

The lower slate is said to measure about ten inches in thickness; it is directly underlaid by the stratum of ferriferous limestone.

This coal clearly overlies that mined by Bondlin in the borough of Scalp Level by as much as from 80 to 90 feet. It has elsewhere been shown that Mr. Bondlin mines the second seam of the Lower Productive series or *bed B*, and J. Weaver's coals would therefore represent beds D and D′ respectively.

The rocks at this point are nearly flat, although inclining slightly to the north-west.

Proceeding up Paint creek, coal openings are seen on both sides of the valley, all the way to *Ashtola*, a short distance to the east of which the Conglomerate appears on the rapidly expiring Negro Mountain, which at this place is no longer distinguishable from the Allegheny Mountain.

But the developments along Paint creek are exceedingly unsatisfactory, and the geological position of the coal beds already opened somewhat obscure.

Schäfer's Mine.—It seems reasonably certain, however, that the coal opened on David Schäfer's land, about 1½ miles southwest of Scalp Level, is near the base of the Lower Productive series. The mine is situated on the south bank of Paint creek, and about 60 feet above the stream.

The coal is soft, friable, and crystallized vertically; it shows well, having a bright, rich appearance, and carrying but little iron pyrites.

At the face of the mine the bed measured as follows:

Black slates.

Fig. 50.

Coal	3′ 10″		
Slate	0′ 1″	4′ 1¼″	
Coal	0′ 2″		

Floor (?)

A hill rises gently southward from the mine to a height of nearly 200 feet, and shows several distinct terraces, which in all probability are coal bearing. A band of ferriferous limestone is said to have been found in this hill, but its outcrop could no longer be located.

Mr. Schäfer further claims to have discovered a seam of coal several feet thick in the bed of the creek below his mine. Its

outcrop is wholly concealed, but black slates and other indications of coal show near water level.

The following section shows the interval between the benches on Mr. Schäfer's hill:

Section at Schäfer's.

Hill top.		
Interval	35′	0″
Bench (?)		
Interval	55′	0″
Bench, said to contain 1′ 2″ coal.		
Interval	30′	0″
Coal in Schäfer's mine, 4′.		
Interval	60′	0″
Coal ?		
Creek level.		

Schäfer's Mill.—Paint creek again forks near Schäfer's saw mill, and the hills to the south and west of the South Branch are beautifully terraced to the top.

If these benches were properly opened they would doubtless furnish the key to the position of the beds now being worked along Paint creek.

On John Stadtler's property, three-fourths of a mile to the south-east of Schäfer's mill, a bed of coal has been exposed in a steep hillside. The bed measures 3′ 8″ at the outcrop, and is underlaid by soft fire clay. It was adjudged to be the same coal as that mined by Schäfer. Forty-five feet below this outcrop a subjacent seam of coal occurs, the thickness of which is unknown. Eight feet of ferruginous slates, holding occasional nodules of kidney ore, overlie the bed. The measures at this point *incline* emphatically to the *south-east*, but the coal has never been worked at this point, and the extent of the dip could not be estimated.

The Conglomerate of XII here shows above the waters of Paint creek. An outcrop of black slates and coal smut occurs about 50 feet above Stadtler's upper coal.

Shelly iron ore was observed on the surface, near the hill top.

On the farm of J. Rose, one mile south-east of the Stadtler mine, a 3′ 10″ bed of coal has been opened, but the outcrop was not followed more than 20 feet under the hill, and the coal does not show to advantage.

A short distance to the south-west of Rose's mine, a bed of coal was seen high up on the hillside. It overlies the seam exposed by Rose certainly by as much as 80 feet; it was drifted upon and 5 feet of coal were exposed. But the old mine is now entirely closed. Black slates show above the coal for 6 feet.

The measures here incline to the north-west at a gentle angle, and the south-east dip observed at Stadtler's can prevail only over a very limited area, and does not exceed at the most a gentle roll in the rocks.

Ripple Mine.—Isaac Ripple's mine is near the head waters of one branch of Paint creek. The coal is worked to the south-east, and the water from the mine drains off easily.

The mine is 160 feet by barometer above the coal exposed on the Rose farm, but both openings are probably on the same bed, which here shows the following section:

Black slate.

Fig. 51.

Coal..... 3′ 10″

Slate..... 0′ 1/8″

Coal in floor.

The mine is 70 feet above water level, and in this interval no coal of importance has yet been found, although black slates and coal smut were observed 50 feet below the mine. And this same coal also shows in the foundation of Ripple's barn to the north.

There is a total absence of the Conglomerate here in any form, which would give to Ripple's coal the appearance of being higher in the series than that seen at either Schäfer's or Stadtler's. But this is uncertain, and can only be determined by the aid of more thorough developments.

Between Ripple's mine and Ashtola a seam of coal about 4 feet thick was seen on land owned by *David Schäfer*. It was supposed to be the same bed as that worked by Ripple.

The highest bed of coal opened and mined throughout this region is on *Andrew Schäfer's farm*, about one-fourth of a mile west of Ashtola.

The country round about is high, and the coal occupies an elevated position in the hill, but there were no opportunities for vertical sections.

Though the bed is small, a good quality of coal is taken from it, and a considerable quantity is shipped in wagons to the mountain top, where the limestone occurring in the measures of XI, far below all the Lower Productive coals, is quarried and burned. It may here be noticed that a great lack of limestone is felt throughout the Paint creek and Shade creek regions. Doubtless the stratum of ferriferous limestone occurs in both the regions, but thus far the search after it has been confined to the beds of the creeks, which for the most part flow over the Conglomerate, and the hillsides have been neglected. It will be remembered that the ferriferous limestone is usually found about 150 feet *above* the lowest workable coal bed.

Schäfer's Mine.—At the face of A. Schäfer's mine the coal worked measures as follows:

Fig. 52.

Black slate.
Coal, bony..... ..... 0′ 3″
Coal..... ..... 3′ 0″

Fire clay in floor.

Iron pyrites were noticed in the coal, occurring as thin flat plates. In structure the coal is decidedly columnar, and the bed was thought to belong to the Freeport group.

The coal is furnished with but little cover, but the roof slate is firm and good, and the coal was hard from the outcrop.

A subjacent seam five feet thick is said to have been found in the bed of a small run, some distance west of Schäfer's mine. The outcrop of the coal was not seen, but with allowance for dip, the interval between the two coals would be about 100 feet.

Schäfer's coal again outcrops on *David Berkey's property* and again on *Hoffecker's farm* to the north-west. Its level at the latter place is 125 feet lower than at Schäfer's. The bed is mined on Hoffecker's land, and shows the same thickness of coal as at Schäfer's, as follows:

Black slate.
Coal..... 3′ 6″
Fire clay.

The mine is situated high up on a hillside, which slopes away to Paint creek.

Just above the bed of the creek five feet of black slates were seen. These slates overlie a bed of coal, the thickness of which is unknown. The coal is regularly underlaid by fire clay.

This outcrop occurs 175 feet by barometer below Hoffecker's mine, and in the interval between are several well marked terraces, as yet unexplored.

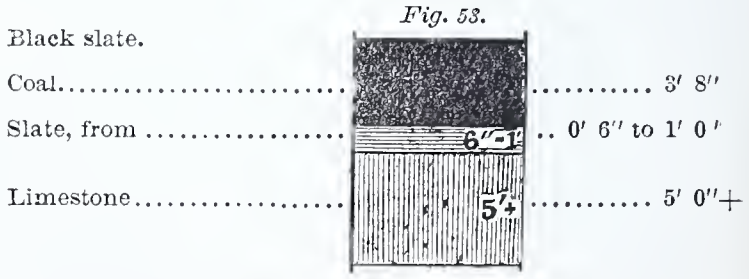
Shade Creek in the Somerset Sub-Basin.

Shade creek is a noisy stream, whose rocky bed falls rapidly. The erosion along its line has been sufficiently great to allow its waters to flow in the Conglomerate all the way from Shade Furnace to its junction with Stony creek near Faust's mills.

The narrow valley through which the creek winds its way still remains thickly wooded; a dense thicket of laurel and underbrush follows the stream closely, and marks the outcrop line of the Great Conglomerate, the massive foundation on which the Lower Productive coal measures rest. The hills bordering the creek rise far above the water, and are coal bearing, but the outcrops and developments hereabouts are so few in number and so unreliable in character, that the identifications here given of the different coal beds seen, must be regarded merely as an approximation. Where the valley broadens, and is free from timber, beautiful and evenly rounded coal benches can be seen terracing the hill slopes to their summits.

Custer Mine.—Just south of Faust's mills, bed D, with its attendant stratum of ferriferous limestone, is mined on Josiah Custer's property, 200 feet above the level of Shade creek. As in the other localities, before described, the coal is separated from the underlying limestone by a thin band of slate, as follows:

Fig. 53.



The coal, in one bench, without persistent slate parting, is hard and bright. Its structure is cuboidal, a form of crystallization markedly characteristic of this seam. It may be noticed in this connection that while the Lower Freeport coal is one of the most variable beds of the Lower Productive se-

ries, its almost invariable cuboidal structure furnishes one of the best guides for its identification in Somerset county.

The underlying band of ferriferous limestone is taken out from Custer's mine in connection with the coal; the limestone is calcined in a large kiln near the mouth of the mine, producing an impure lime, streaked with a reddish tinge. It is this product, however, which supplies Shade township with nearly all the lime used there for agricultural purposes.

This same bed was traced north-east for one-half mile on to *Faust's land* where it was dug into 110 feet higher on the same hillside. Coal has been found near the foot of a high bench, but never fairly opened up. Examinations were made for the Johnstown bed of carbonate iron ore, 60 feet above this last coal. Ferruginous shales, with balls of rough ore, were met with a few feet below the surface, but it is intimated that the results obtained by these excavations were not satisfactory.

Mr. Faust further claims to have found two coal beds between his opening on bed D and Shade creek.

The lowest workable coal bed of the series, bed A, outcrops in an orchard to the west of Mr. Faust's house. The thickness of this seam could not be ascertained, but it is asserted that several feet of outcrop coal were exposed at one time. The bed is here about 90 feet above the creek level, the following rocks being exposed in the interval.

Coal, bed A (?).	
Interval	from 5′ 0″ to 10′ 0″
Sandstone, massive	25′ 0″
Coal smut	1′ 0″
Sandstone and sandy shales, holding balls of siliceous iron ore	25′ 0″
Massive sandstone	20′ 0″
Coal	0′ 8″
Fire-clay	?
Massive sandstone to bed of creek	8′ 0″

These rocks incline to the south-west at an angle of from 2° to 3°.

About forty feet above the outcrop of bed A, a second workable seam was once drifted in upon and found to yield full four feet of good coal. The old opening is now closed, but the outcrop most probably belongs to bed B. Twenty-four feet, by barometer, still higher, a small and unimportant coal bed occurs, and bed D, with its limestone, shows 63 feet above this

outcrop, which would make a complete section of the Lowe Productive coals as high as the Lower Freeport bed. The hil continues to rise far above this point, with the following benches on its slope (Fig. 54; Page Plate IX):

Vertical Section at Faust's Mill.

Hill top, thin sandstone covering surface.		
Interval	18′	0″
Bench.		
Interval	45′	0″
Bench, opened up, but found to be barren.		
Interval	57′	0″
Bench, barren.		
Interval	33′	0″
Bench, contains ferruginous shales and iron ore, as described above.		
Interval	58′	0″
Bench; coal, bed E (?)		
Interval; the bench of bed D′ does not show in the interval	112′	0″
Coal and limestone, bed D.		
Interval	63′	0″
Coal, small, bed C (?).		
Interval	24′	0″
Coal, bed B (?).		
Interval	40′	0″
Coal, bed A (?)		
Interval	90′	0″
Shade creek.		
Total	540′	0″

In ascending Shade creek, no further developments are me until the neighborhood of Ott's saw mill is reached, two mile above Faust's.

Enormous masses of conglomerate sand-rock (XII) are here visible both in the bed of the stream and on the flanks of the hills for 50 feet above the water. At this place the valley widens for a short distance, and the hillsides falling with a gentle slope towards the creek show the terraces of the princi pal coal beds included in the Lower Productive series.

J. Berkey Mine.—An opening has been made on Bed B abou one-half of a mile to the south-east of the saw mill; it is o Jacob Berkey's farm, about 200 feet above the creek level a Ott's mill. Where opened the bed is nearly 6 feet thick in all parted by two thin bands of slate.

The upper bench alone is worked by Berkey and yields ful 4 feet of excellent coal. The following measurement of th bed was made in the mine:

SECOND GEOLOGICAL SURVEY OF PA.

1875

Fig. 48.

PAINT CREEK.

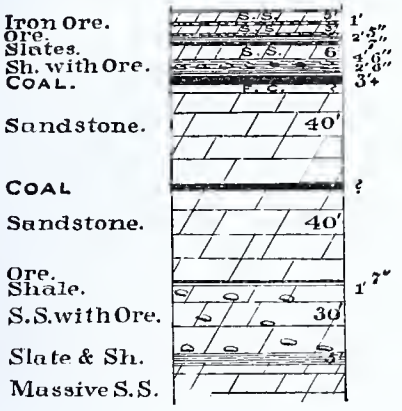


Fig. 54.

FAUST'S MILL

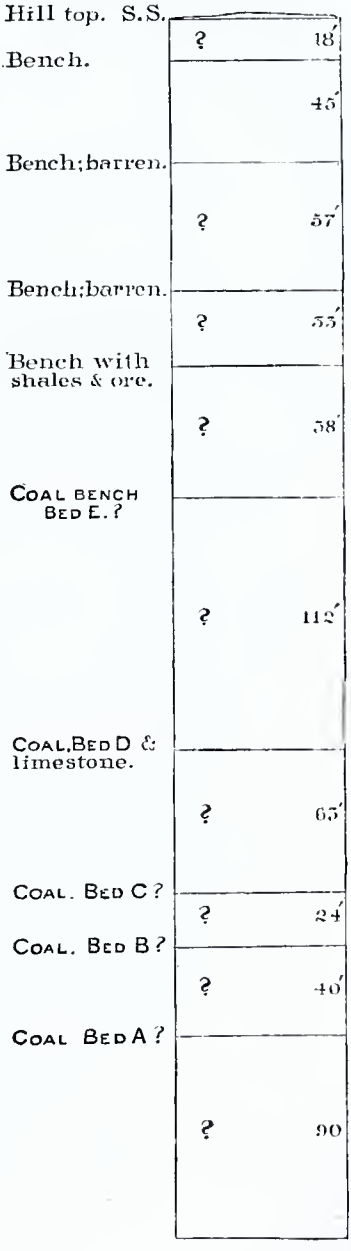
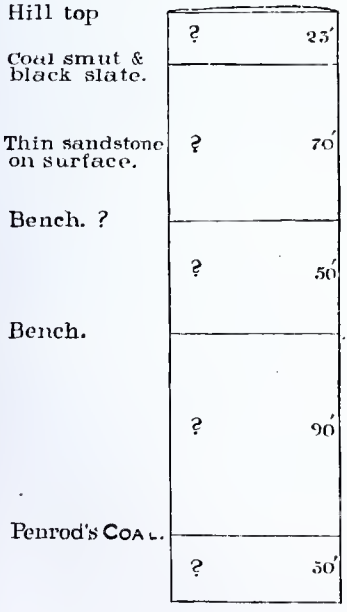


Fig. 61

CHERRY HILL.



O.B.H.

Fig. 55.

Slate.			
Coal	4′ 0″	4′ 9″	
Slate	0′ 3″		
Coal	0′ 6″		
Slate	?		
Coal	?		
Fire-clay.			

The coal is soft and friable, and crumbles in mining.

A "4-foot bed" is reported to have been found about 50 feet lower down in the measures.

From 80 to 90 feet above Berkey's mine, 4 feet of coal were once opened up at the outcrop, but the bed was never followed for any distance under the hill.

Jacob Custer Mine.—Continuing along the flank of this hill, the same coals show on Jacob Custer's farm, 1¼ miles south-south-east of the Berkey mine.

Though the coals are at a greater elevation at Custer's than at Berkey's, they are at about the same distance above water level at both places, showing that the bed of the creek rises at about the same angle as the rocks and in the same direction.

Bed B measures as follows in Custer's mine:

Black slate.	
Coal	4′ 2″
Slate	0′ ¼″
Coal	?

Only the upper portion of the bed is here mined, the lower benches being small and unimportant, and allowed to remain in the floor.

The bed shows well; the coal has a rich appearance, and is of columnar structure. Some coke has been made from it in front of the mine, merely to test its adaptability in this direction. The coking was roughly done, but the article produced indicates that the unwashed coal will not make a superior quality of coke.

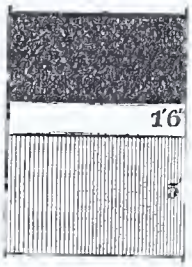
A rich outcrop of coal and black slate occurs in the same hill 60 feet below Custer's mine. This bed has been opened by Custer and found to yield 3½ feet of pyritous coal. A subjacent seam, nearly 2 feet thick, is found in the Conglomerate, from 60 to 70 feet still lower.

But 90 feet above Custer's mine is an outcrop of coal and limestone, which enables the coal seams opened throughout this section of country to be identified with tolerable accuracy.

Very recently this outcrop was thoroughly investigated by Mr. Custer, and a complete section of the bed was obtained, with the following results:

Black slate. (?)

Fig. 56.



Coal		3' 8"
Soft clay slate		1' 6"
Limestone, ferriferous		5' 0"

Fire clay, good. (?)

This outcrop clearly belongs to bed D, or the Lower Freeport coal, but as it occurs near the top of the hill, no higher beds are included.

A deposit of iron ore is claimed to have been found some distance above Shade creek, below the mouth of Roaring Fork. This ore is not now visible, but it probably belongs to the same horizon as that once worked near Shade Furnace, of which mention is made on a succeeding page. At Hillsborough (mouth of Roaring Fork) the rocks were observed to dip regularly to the north-west.

J. Knebel Mine.—One and three-fourths miles to the north-east of Custer's, bed B (?) again outcrops in a ravine caused by a small run flowing northward and ultimately finding its way into Paint creek. The bed has been drifted in upon by Jacob Knebel at an elevation of nearly 3,000 feet above tide water. The mine is run to the south-west, the coal leaning to the north and east. The following measurement of the coal was obtained:

Black slate.

Fig. 57.

Coal		4' 1"
Slate		0' 1"
Coal		

Near the mouth of the mine the slate parting dividing the bed was full 6 inches thick, and a second bench of coal, 1½ feet thick showed underneath the slate.

A small and unimportant coal seam has been dug out in tilling the soil, about 40 feet above Knebel's mine, but the hill does not here rise sufficiently high to include at this point even the lowest member of the Freeport group.

Some distance further down the run a seam of slaty coal outcrops near the water. This was estimated to underlie the bed in Knebel's mine by as much as 50 feet. The specimens from this lower bed showed a slight cannel structure, but the coal is intermixed with too much slate to possess value for any purpose. The outcrop has never been investigated, and the thickness of the coal is unknown.

Huskin's Run.

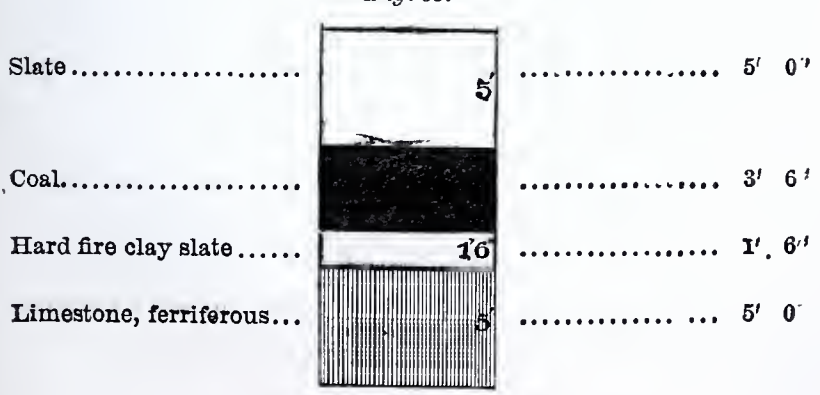
At the mouth of Huskins' run all of the Conglomerate of XII is above water, and the red shales of XI make their appearance, capped by massive sandstone.

The Conglomerate has here a thickness of at least 200 feet, and perhaps even more.

At this point the rocks show a broad roll, sweeping northeast and south-west, but the main dip is obviously to the northwest.

Rodger Mine.—Following up Huskins' run to the southward, the lower coals are plainly above water level, but their outcrops are not visible in the ravine. Mr. David Rodger mines bed D near the head waters of the run, about 60 feet above the water. The coal shows the same characteristic structure noted almost everywhere in connection with it, and apparently carries but little sulphur in the form of iron pyrites. The bed measures as follows:

Fig. 58.



A specimen of the limestone was forwarded to Harrisburg for analysis, and there yielded (D. M'Creath):

Carbonate of lime	52.940
Carbonate of magnesia	16.060
Carbonate of iron	5.800
Alumina	4.440
Sulphur	.088
Phosphorus	.058
Insoluble residue	17.770
	97.156

Limestone hard, compact, sandy; slaty color; spotted with iron pyrites."

The coal here dips to the northwest, though gently.

Fifty feet above the mine another seam of coal was discovered, nearly two feet thick, overlaid by sandstone. Sixty-six feet still higher in the same hill is the outcrop of a third seam.

The intervals between these coals will be found to correspond with those between the coals of the Freeport group, as given in the typical sections.

Huskin's Run Iron Ore.—A short distance to the east of the mine the same hill rises still higher, and near its top a deposit of iron ore was at one time benched, and the ore used at Shade furnace.

The stripping was continued for a considerable distance, and the deposit is therefore probably of value; but the work was done many years ago, and no estimate can now be formed of the amount of ore taken from the place. It apparently existed in a mass of red ferruginous shales 6 feet thick.

It must be understood, however, that this is not the deposit of iron ore on which Shade Furnace was established and run for many years. About one-half mile south-west of the Rodger mine a band of *limestone* was recently discovered. It certainly overlies bed D by as much as 100 feet. But as nothing was seen beyond the disintegrated mass at the extreme outcrop, it is not known whether the stratum is of importance or not. It certainly deserves thorough investigation, inasmuch as limestone for fertilizing purposes is very much needed throughout this section, and the ferriferous band of limestone underlying bed D is in this vicinity so impure that it cannot be used for

the purpose. Attempts have been frequently made to calcine the limestone from this latter deposit, but have not resulted satisfactorily.

Shade Furnace.

Shortly after crossing Huskin's run, on the road from Rodgers house to Shade Furnace, extensive ore strippings are observed stretching to the north and south. This old work, done at intervals, may be said to represent the various unsuccessful attempts that have been made from time to time to establish a small blast furnace on Shade creek.

It has long been well known to persons residing in this section that an abundance of iron ore exists not only around the site of old Shade Furnace, but all along Shade creek, so far as careful search has been made for it. And the knowledge of the existence of this deposit led to an organized and systematic attempt at its development early in the present century. This attempt, though productive of some satisfactory results, failed.

Later on, however, the efforts were renewed a number of times under the direction of different individuals; but each attempt in its turn resulted disastrously, and the old furnace went finally out of blast nearly twenty years ago. As before intimated, these discouraging results did not follow from a lack of ore, or any complaint that could be brought against the quality of the iron made; but they were the direct consequence of the isolation of the furnace, and its great distance from a market.

The ore is imbedded in a stratum of shales 15 feet thick; it occurs as "balls" and lenticular masses deposited in layers through the shaly mass. A large quantity of ore still remains piled up about the old furnace stack. It seemed of fair quality, though somewhat sandy.

A second deposit of ore was found 25 feet lower in the same hill. This deposit was also benched for some distance, and is said to have yielded an abundance of good ore. It occurs as flat plates in sandy shales.

The geological horizon of these ore deposits could not be determined with positive accuracy, but it is reasonably certain that they belong to he upper portion of the massive conglomerate of No. XII.

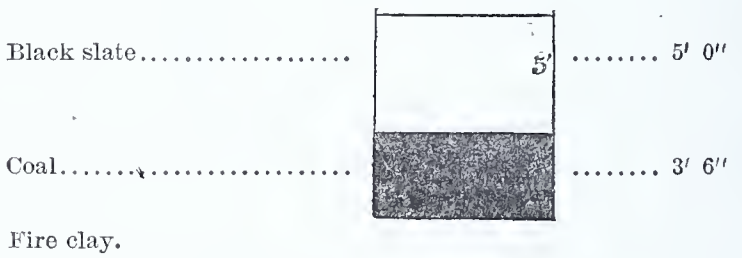
A rich outcrop of coal and black slates was observed in the road a few yards west of the "strippings" on the upper ore stratum. The coal has never been opened up at this place, and its thickness is unknown. It underlies the ore by about 30 feet. Evidences of coal are also seen 22 feet above the ore, but these beds are doubtless too small to be of value.

Coffee hill, to the south of the ore bank, rises softly for 200 feet and shows several distinct coal terraces.

Wyand Mine.—One-fourth of a mile to the south-west of the old Furnace, a bed of coal was opened many years ago on Mr. Wyand's land, and has been worked more or less ever since.

The measures are here very flat, the gangways of the mine being driven in almost every direction. A slight incline in the rocks to the north-west was however noticeable. The coal bed as mined measures as follows:

Fig. 59.



The coal is bright and shining, but pyritous.

This coal may possibly pass under the upper ore stratum at the furnace; but this is doubtful, and it would rather seem to overlie the ore by a small interval.

Cherry Hill.

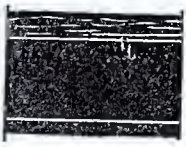
Near the top of Negro Mountain, in its prolongation northward, a valuable bed of coal has been opened above water level on three farms lying contiguously.

Penrod Mine.—The principle one of these mines is on Mr. Henry Penrod's property, near Cherry Hill post office.

The drift was started in on a north-westerly course and continued in this direction for a short distance, the coal remaining nearly flat. But a gentle north-west dip of the rocks into the Second Sub-basin having set in, the gangway is now driven to the north-east.

The coal bed shows this section near the mouth of the mine:

Fig. 60.



Black slate.				
Coal, bony	.....	0′ 11″		
Slate	.....	0′ 1″		
Coal	.....	3′ 4″	4′	10¼″
Slate	.....	0′ ¼″		
Coal	.....	0′ 6″		
Floor, hard fire-clay.				

The coal is of columnar structure and carries some iron pyrites.

The thin band of slate, near the top of the bed, is absent at times, though usually present.

The hill to the north-west of the mine shows several distinct benches, at distances which would indicate that Penrod works bed *B*. But this cannot be stated positively.

Vertical Section at Cherry Hill.

Fig. 61 (Page Plate IX) gives the vertical distances between the benches in the hill side, thus:

Hill top.		
Interval	23′	0″
Coal smut and black slates	?	
Interval, surface covered with thin sandstone	70′	0″
Bench (?).		
Interval	50′	0′
Bench.		
Interval	90′	0″
Penrod's coal.		
Interval	30′	0″
Small run.		
Total	263′	0″

Wilt Mine.—An opening on the same coal has been made by Jno. Wilt, one-half of a mile south-east of Penrod's mine.

The bed shows almost no difference, either in thickness or quality. It measures as follows:

Coal, bony	1′	0″	
Slate	0′	1″	
Coal	3′	2″	4′ 11⅛″
Slate	0′	⅛″	
Coal	0′	8″	
Hard fire-clay.			

The same bed is also above water level on *E. Specht's farm* a short distance to the south of Wilt. The opening at this place had only recently been made and was not in beyond the soft coal of the outcrop.

Evidences of overlying coal seams occur all the way up the hill from Specht's mine. One of these outcrops is rich and promising, and is worthy of investigation; it occurs about 90 feet above Specht's coal.

The same coal beds as are here above water level are also found on *Jacob Brubaker's land*, to the south-east.

Quemahoning Creek in the Somerset Sub-Basin.

At Morgan's mills the stream has forced its way through the ridge of the Viaduct antielinal sub-axis, cutting it to its base, thereby exposing the massive Conglomerate, and leaving the lower coal beds in the tops of the hills.

Three beds of coal, identified as A, B and D of the Lower Productive series, outcrop in the steep hillside to the east of the woolen mill.

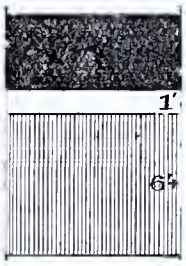
The anticlinal axis passes a short distance west of this point, and the rocks are rising rapidly towards it. Bed D fails to strike the hill rising to the west of Morgan's factory, and therefore spans the arch in the air. Bed B, opened up at a number of places in this vicinity, and everywhere yielding a rich, pure coal, crosses the antielinal at Morgan's, possibly in the same way, for the search after it in the hill skirting the western border of the creek has not yet resulted in its discovery. But abundant evidences of coal, adjudged to belong to this same seam, were observed on the hill top, and it is therefore very possible that bed B crosses the arch at this point under a thin covering.

From Morgan's the creek is carried, by an easterly course, rapidly into the basin, and the lower coals disappear under the surface in following the Quemahoning, while the Freeport group approaches water level.

Thus, for example, bed D and the ferriferous limestone outcrop on *D. Weaver's property*, 2 miles below Morgan's. The coal is here 40 feet above the creek, but is carried rapidly upwards by its north-westerly rise, and on Morgan's hill it is more than 250 feet above water level.

Weaver Mine.—At Weaver's mine the bed (D) is regular, and shows in one solid bench of coal over 3 feet thick. Its structure is cuboidal, and the coal is hard and bright. It is almost directly underlaid by 6 feet of ferriferous limestone, thus

Fig. 62.



Bed D is almost invariably provided with an excellent roof of hard, tough, carbonated clay slate, and the sandstone showing over the coal in Weaver's mine is therefore evidence of an irregular state of things, although the coal seems in nowise disturbed or reduced in size.

The outcrop line of this bed is easily traced round the hills crossing the numerous small runs that flow eastward into the Quemahoning, and has been again opened on *Mumman's farm*, a short distance to the north of the Weaver mine. At this place the limestone is quarried and calcined.

On Mr. Morgan's property this bed has been located, but never worked.

Morgan Mine.—Bed B is exposed one hundred feet farther down the slope. The main bench of the bed is small, but the coal taken from it seems remarkably free from all impurities. The following section shows the average thickness of the bed:

Fig. 63.

Black slate, tough and hard.

Bed A outcrops sixty feet lower. It is said by Mr. Morgan to be full three feet thick, but made up of worthless coal.

The massive Conglomerate shows a few feet below this outcrop, and fills the channel of the creek with huge masses of sandrock.

Bowman Mine.—A small branch of Quemahoning creek heads up near the top of the ridge on D. Bowman's farm. Bed B is just above water level at this place, and is mined by Mr. Bowman.

The bed shows the same partings of slate that were observed in Morgan's mine, and is otherwise unchanged.

The gangway of Bowman's drift is driven in a north-west course, and rises steadily, the water flowing off easily. Besides the normal dip of the rocks to the south-east, there is also a decided leaning to the south-west. The surface of the country rises softly to the westward from Bowman's, the coal rising with it and keeping close to the surface all the way to the centre of the axis, near which point it has again been opened by *Wm. Apple.*

At the face of Bowman's mine bed B shows as follows:

Black slate.				
Coal	3′	0″		
Slate	0′	1″		
Coal	0′	5″	3′	11½″
Slate	0′	½″		
Coal	0′	5″		
Slate.				

A considerable quantity of coal is taken from this mine and sold in the neighborhood. It is said to burn freely and produces very little clinker.

One hundred and thirty feet above Bowman's mine a stratum of blue limestone, 2 feet thick, was found. This limestone is overlaid by about 18 inches of coal, and possibly marks the outcrop of the Middle Freeport bed. (?)

Higgins' Run.—Near the head waters of Higgins' run, an affluent of the Quemahoning, a bed of coal outcrops on *Wm. Berkey's property* about two miles west of Stoystown. The relative position in the measures could not be determined with precision, on account of its isolation from all other openings.

The bed yields full 3 feet of coal in all, though the upper bench is poor and slaty, and of little account. The lower bench seemed fairly good, but carried a rather damaging amount of slate and pyrites.

The following measurement was made near the present face of the mine:

Black slate.				
Coal	0	10″		
Slate	0′	1′	3′	1″
Coal	2′	2″		
Slate.				

CHAPTER IX.

Kimberlin's Run, Coxe's Creek and Scrubglade Run.

Kimberlin's run is the east branch of Coxe's creek. It heads near Fairview village, on the top of the Negro Mountain axis, flows through the south-eastern corner of Somerset township, and joins the north branch of Coxe's creek in the vicinity of Somerset town.

The rocks of the Lower Productive system make up the country rock of the region through which the run flows. These measures are seen not only in the shallow valley of the run, but also in the high land to the north, which is indeed a part of the central plateau which divides the waters of the Castleman from those of the Conemaugh. So far as confined to the Somerset sub-basin this belt of high country is broadly indicated by the line of the Somerset and Bedford pike, which runs along its crest.

The south-eastern corner of Somerset township consists mainly of timber land. That portion of it drained by Kimberlin's run is almost wholly uncultivated, excepting at the head springs of the stream, where the section exposed extends from the top of the Freeport group down as low as bed B.

The developments, therefore, about to be described occur principally in the neighborhood of Fairview village.

Vertical Section on Kimberlin's Run.

The following section obtained chiefly on Mr. George Zimmerman's farm shows the intervals between the coal beds of this region:

Coal, E ?	3′	0″
Interval, estimated	60′	0″
Coal, D′	2′	6″
Interval	35′	0″
Coal, D ?	3′	0″+
Limestone	6′	0″

Interval		70′ 0″
Coal, B ?	from 4′ 0″ to	5′ 0″
Interval		32′ 0′
Water level.		
Total		216′ 6″

Zimmerman Mine.—Only the lowest coal bed is worked on the Zimmerman farm, about $1\frac{2}{3}$ miles south-west of Fairview village.

The mine was opened on the western bank of a deep ravine, and has been operated in a small way for a number of years.

The bed varies both in quality and thickness. In the mine the following average section was obtained:

Fig. 64.

Slate.

Coal	2′ 8′	
Slate	0′ 4″	4′ 0″
Coal	1′ 0′	

Hard fire clay.

A few hundred yards to the north-east the same bed was again opened by Mr. Zimmerman, who states that it there showed full five feet of coal, exhibiting also its characteristic slate parting near the floor. It is questionable, however, whether the bed would have maintained this thickness for any considerable distance.

A partial examination of Mr. Zimmerman's mine showed that the bed produces at times a good clean coal, while again the yield is both slaty and pyritous. Any single specimen of the coal is therefore liable to do more or less than justice; but if the specimens forwarded to the State Laboratory by Mr. Zimmerman should fairly represent an average, the bed certainly cannot take rank among good bituminous coals.

The analysis is as follows (D. M'Creath):

"Water	.630
Volatile matter	15.565
Fixed carbon	67.420
Sulphur	3.590
Ash	12.795
	100.000

Coke per cent, 83.805; color of ash, gray.

The coal has a resinous lustre, is very tender, and seamed with charcoal and iron pyrites."

The same bed is reported to outcrop just above water level at Fairview village.

On Mr. Zimmerman's farm the hill rises westward to a height of more than 100 feet above the mine on bed B, thus including two higher seams of coal, both of which have been opened by him.

The first is found at an interval of about 75 feet above the mine last described.

It shows about three feet of coal, including also a small parting of slate. This probably does not express the full thickness of the seam, which has been incidentally exposed in quarrying the limestone by which it is underlaid.

The limestone band is upwards of 6 feet thick; it is highly impure, containing nearly 4½ per cent of carbonate of iron and about 25 per cent of silicious matter (insoluble residue).

Nevertheless it slakes after hard burning, and is used by Mr. Zimmerman for fertilizing purposes.

The full analysis of this limestone is as follows (D. M'Creath):

"Carbonate of lime	63.969
Carbonate of magnesia	4.244
Carbonate of iron (with a little alumina)	4.393
Sulphur	.385
Phosphorus	.142
Insoluble residue	24.780
	97.413

The limstone is compact, sandy, and a bluish gray color."

The next higher coal is found capping the extreme hill top, just above Mr. Zimmerman's house. It was opened at one time by Mr. Zimmerman to ascertain the thickness of the bed, and was found to yield two and one-half feet of coal.

Both these latter beds are better known along the pike to the north-east, and are more fully described further on.

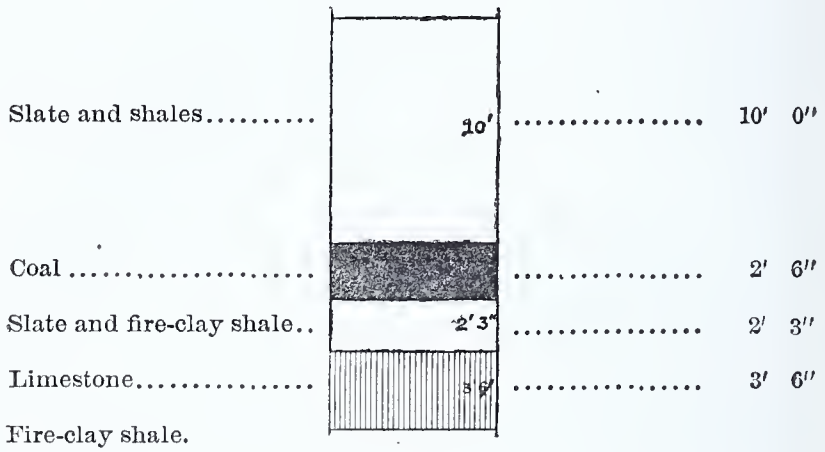
Across the run to the east of Zimmerman's house, the hill rises sufficiently high to include all the rocks found on the Zimmerman farm, although the rise of the measures is here to the south-east, the centre of the Negro Mountain anticlinal passing near Mr. George Walker's house.

The lowest coal bed of the Freeport group (D) here crosses the arch under cover, and has been exposed on the *George Walker farm*, and again on the *Daniel Coleman farm* to the south.

Baer Mine.—Following north-east along the anticlinal for about one mile and a-half, a small bed of coal, underlaid by limestone, is seen at the pike on the property of Mr. S. Baer.

Both the coal and limestone are here quite extensively developed, and an accurate section of the deposit was therefore obtained. It is as follows:

Fig. 65.



The coal is bright, moderately soft, and mines easily. It shows rather a large amount of iron pyrites, but is employed mainly in calcining the limestone, which is also impure and yields a reddish lime, indicating the ferriferous character of the rock.

This mine occupies a position near the top of the hill, and no higher beds are included on the Baer farm. Moreover, the bed here mined does not cross the axis under cover, for Mr. Baer's mine is a short distance *east* of the anticlinal, the coal in the mine showing an unmistakable south-east dip. It therefore properly belongs to the most easterly of the sub-basins, but inasmuch as it is so closely connected with developments at Fairview, it was thought advisable to class it among the latter.

Will Mine.—Only a few hundred yards north-west of the Baer mine, the same bed was again opened on the property of Mr. Wm. Will.

It is reported by Mr. Will to have shown identically the same section so far as the coal is concerned; but it is claimed that the limestone band quarried by Mr. Baer could not be dis-

covered on the Will property, although vigorous search was there made for it.

It should be stated that from excavations made on an adjoining farm to the north-west, it was established that the fire-clay stratum separating this limestone band from the coal above is not of uniform thickness, and that a state of things dissimilar to that seen in Baer's mine may be looked for even over small areas. This is further elaborated in a subsequent section.

The outcrop of the bed is easily traced north-east through Mr. Will's fields, until the Upper Freeport bed comes in a short distance from the house and crowns the hill. The bench of the coal is plainly marked, but the bed has never been explored on this farm.

Descending the hill towards the run, the Zimmerman section (see p. 153) is repeated as far down as the ferriferous limestone, which has been exposed a few feet above the run, and is the lowest available stratum above water level on the Will property.

The extreme outcrop of the limestone is all that is exposed, and the coal does not show immediately above, being replaced by loose wash and clay. The limestone is highly ferriferous and of the same general character as that quarried by Mr. Zimmerman.

The strata dip gently north-westward across the ravine, and pass under the *farm of Mr. Levi Walker*, by whom beds D and D′ were exposed in a field just south of the house and buildings; and bed E appears still higher in the same field, the outcrop showing in the road.

The Lower and Middle Freeport coals have been again exposed on this farm at a point some distance west of Mr. Walker's house.

Where opened the Lower Freeport Coal is only a few feet above water level, and in going westward disappears at once under the run. It was only partially opened up for the sake of determining the character of the limestone by which the bed is underlaid.

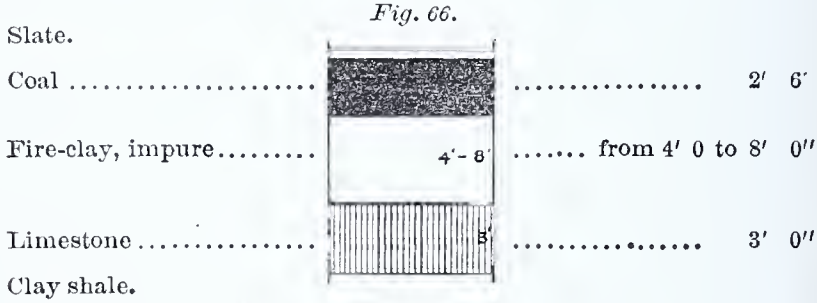
The limestone deposit is divided into three layers, parted by thin bands of impure fire-clay shale; it is claimed to be in all six feet thick, and contains iron and alumina in sufficient quantities

to destroy its usefulness for agricultural purposes. It is separated from the coal by a thin stratum of black slate, the average thickness of which does not exceed 6 inches.

The next coal bed above shows 35 feet higher. This was likewise opened with a view of obtaining the limestone band quarried by Mr. S. Baer. But the excavations here were brought to a close when a depth of 5 feet below the coal had been reached, the rock cut through being soft fire-clay. No limestone was found, and judging from the condition of things at Baer's, further digging seemed inadvisable.

L. Schäfer Mine.—Recent excavations, however, on an adjoining farm, a few hundred yards distant from Mr. Walker's openings, disclosed the limestone 8 feet below the coal, and a gangway driven in at this place showed that this interval steadily decreased until the clay assumed a thickness of about 4 feet, which it has thus far maintained. The section is as follows:

Fig. 66.



The mine is on Mr. L. Schäfer's farm.

The coal is of small importance, except in connection with the limestone, which is reasonably pure and produces a fair lime, though bearing a red tinge. It is now being quarried by Mr. Schäfer in considerable quantities, and is in fair demand among the farmers.

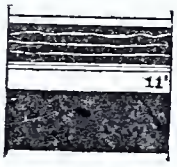
Returning again to the Bedford pike, and following it westward towards the county seat, the Lower and Middle Freeport coal beds are traced without difficulty for the entire distance, the Upper Freeport bed occasionally coming into the hilltops.

In describing the principal developments seen along the pike between Fairview and Somerset, the description will follow westward, but no attempt will be made to classify the details of each coal bed. It will be borne in mind that the description follows very nearly in the dip of the rocks.

Kimmel Mine.—About three-fourths of a mile north-west of Fairview Mr. Daniel Kimmel mines coal bed D, the Middle Freeport seam showing on the hill 35 feet above. The gangway of the mine, driven north and north-west, sinks steadily, but very slowly, and indicates a gentle dip. The hill is narrow and as the bed outcrops on the opposite side to the west, the water thus drains off and the coal can be worked in that direction. All of the bed is here exposed, showing this section:

Slate.

Fig. 67.



Coal, slaty	1′	8″	
Slate	0′	1″	
Coal	0′	1″	5′ 5′
Slate	0′	11″	
Coal	2′	8″	

Fire clay.

Below this fire clay the stratum of ferriferous limestone is said to have been exposed, but was found to be worthless on account of its impurity.

From the mine the country falls gently away to the east, and bed B is reported to have been at one time exposed a few feet above Kimberlin's run.

The Freeport coals pass from hill to hill, and are again seen on *Mr. Henry Fox's farm*, about one-third of a mile further west. Here the ferriferous limestone (under bed D) is quarried and burned, the Middle Freeport bed furnishing the coal necessary for the kiln.

The limestone is overlaid by 1½ feet of fire clay, above which the Lower Freeport coal appears as follows:

Coal	3	3″	
Slate	0′	3″	4′ 0″
Coal	0′	6″	
Fire clay	1′	6″	

Limestone.

It will be observed that in this section the bed differs markedly from that obtained in Mr. Kimmel's mine.

The limestone is exceedingly ferriferous, and requires hard burning; when slaked it yields a poor lime, filled with lumps of calcined ore.

The mine on bed D′ is situated about 40 feet above the quarry. The bed yields $2\frac{1}{2}$ feet of coal in this way (C. A. Young):

Slate	0′ 3″	2′ 9″
Coal	1′ 6″	
Slate	thin.	
Coal	1′ 0″	
Fire clay.		

The gangway is driven east north-east, and rises slightly.

The coal is fairly good, but carries considerable sulphur as iron pyrites.

J. Schäfer Mine.—An outcrop of a third seam of coal occurs in a clump of woods about 60 feet above this mine. This is clearly the crop of the Upper Freeport bed, which has been opened and is worked by Mr. Jno. Schäfer, a short distance to the west, in whose mine the bed shows (C. A. Young):

Slate.		
Coal	2′ 0″	3′ 0″
Slate	thin.	
Coal	1′ 0″	
Fire clay.		

The coal is bright, shining and presents a handsome appearance.

On the adjoining farm of Mr. Henry Fox, to the south-west, the Lower Freeport coal bed has again been opened by Mr. *Samuel Rhodes.*

The mine was but recently started, and the coal does not show at its best.

An outcrop of a lower seam was seen in a field to the east, about 80 feet below the mine; this was identified as belonging to Bed B.

Coal bed D′ was also found on this farm, 35 feet above the mine, on bed D.

B. Schäfer Mine.—The Lower Freeport bed is further developed by Mr. Bodis Schäfer, and again by Messrs. Woy & Bro. further west. In Schäfer's mine it shows:

Sandstone.		
Black slate	0′ $1\frac{1}{2}$″	4′ $5\frac{1}{2}$″
Coal ..... from 2′ 6″ to	3′ 0″	
Clay, soft	0′ 6″	
Coal	0′ 10″	
Fire clay.		

A shallow hill covers the mine, and the coal is rusty, but it is hard and marketable for local consumption.

The Middle Freeport coal shows in the road a few yards east of Woy's house.

A short distance north-east of these openings and with little or no variation in level (as determined by barometer,) the same coals are developed on the farm of *Mr. Daniel Rhodes.*

The Lower Freeport coal underlaid by the ferriferous limestone stratum, has here been opened up only a few feet above water level. The gangway of the mine had scarcely reached the hard firm coal, but the characteristic parting was nevertheless observable, separating the bed into two uneven benches, the upper of which was full three feet thick, and the lower only ten inches.

A thin band of black slates separates the coal from the limestone.

Eastward the hill rises high above the mine, and includes the other members of the group, as well as, perhaps, the Mahoning Sandstone.

Bed D′ was once mined on this property forty feet above the present opening on bed D.

The bench of bed E shows plainly on the hill slope, but has never been explored.

Coxe's Creek.

From Mr. Woy's house the road descends directly into the valley of Coxe's creek, an important affluent of the Castleman, and which drains the country between Somerset and Mineral Point.

As yet the valley has been but little cultivated; portions of it have been cleared of timber and divided up into farms; but in the main it is a wilderness of barren land from which the valuable timber has in large part been cut.

The main branch of the creek heads in the high land to the north of Somerset; its south-west course keeps it close to the synclinal axis of the Basin, which leans in the same direction.

The fall in the creek, from its headwaters to its mouth, is full 350 feet, and starting far up in the Lower Productive coal measure rocks, the various beds of coal, limestone, fire-clay and iron ore included in these rocks, are found on the hills bordering its banks until at Mineral Point, where the creek joins the river, the base of the series is reached.

Between Somerset and Milford station the creek is enclosed by low hills, the surface of which is thickly strewn with boulders of heavy sandstone, often conglomeritic in character; these masses come from the Freeport sandstone.

But below Milford the hills become higher, and lower measures are brought to daylight as the valley deepens, the sandstone deposit, so destructive to the cultivation of the soil, occupying relatively a more elevated position, until at Mineral Point, it covers the hilltop.

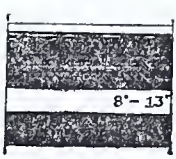
Somerset.

The town of Somerset is built on the summit of a hill which for a short distance follows the western bank of Coxe's creek. Both the Lower and Middle Freeport beds pass underneath this hill, and the Upper Freeport coal (bed E) strikes the surface at the western outskirts of the town. These beds have here been known for a number of years, during which time the town has been supplied with fuel from mines in the immediate vicinity.

A distinct and well defined bench, forty feet in height, borders the eastern bank of Coxe's creek as it flows past Somerset. The bench holds beds D and D′, which are about 35 feet apart.

Weimer Mine.—The Lower Freeport bed was opened a few feet above water level on the Fink property, a short distance south-east of the eastern outskirts of the town. The mine is now closed, but the same bed was again opened on Weimer's land, about one mile west south-west of the Fink opening. The coal is here just at the water level, or perhaps a few feet below the bed of the creek. It was shafted upon from near the top of the bench, and was found thirty feet below the surface. The coal measures as follows:

Fig. 68.



Slate.
Coal, bony ..... 0′ 3″
Coal..... 2′ 3″
Slate..... from 0′ 8″ to 1′ 1″
Coal..... 1′ 6″
} 5′ 1″
Slate in floor.

The beneh holding the Middle and Lower Freeport coals terminates at Mr. Cunningham's house, sinking gradually into

low land, and the outcrop of the bed is then thrown eastward for some distance.

The Middle Freeport bed here crosses Coxe's creek in the air; the outcrop is seen on the hillside a few feet above the mouth of Weimer's shaft, and is again observed on the opposite side of the creek, in the road. The bed is said to measure about 2 feet thick. It is presumably underlaid by limestone, but of this nothing positive is known.

Hugus Mine.—Ascending the hill on the western side of the creek, bed E is seen to outcrop in an orchard about one-half mile south of Somerset, on land belonging to Isaac Hugus, Esq. The bed was shafted upon on the same farm further west, and is there 40 feet below the surface. Its outcrop forms a distinct bench on the hill east of the shaft, and the bed has been opened up at several points on Mr. Hugus' land.

It shows here as follows:

Fig. 69.

Black slate.			
Coal, bony	0′	4″	
Coal	2′	5″	
Slate	0′	1″	3′ 9″
Coal	0′	5′	
Slate	0′	1″	
Coal	0′	5″	
Fire-clay.			

The coal is soft, friable, of columnar structure, and is easily mined, but crumbles considerably in the operation; it holds a very small amount of sulphur, and cokes easily, being much preferred by the blacksmiths to the coal mined from bed D. But aside from all other considerations, the amount of slate in the bed (if the specimen of coal analysed can be taken for the average) is injurious to its character as a merchantable coal. The analysis by Mr. A. S. M'Creath, Chemical Assistant of the Survey, is as follows:

"Water	.860
Volatile matter	16.885
Fixed carbon	66.055
Sulphur	.585
Ash	15.615
	100.000

Coke, per cent, 82.255; color of ash, gray."

At the Hugus shaft the hill rises only high enough to afford good protection to the coal, but in going westward, towards the

synclinal axis, higher rocks come in and the lower portion of the Barren Measures spread over the country.

Hoover Mine.—To the south-west the land is sufficiently high to include a thin seam of coal, estimated to overlie that in the Hugus shaft by as much as 50 feet. Evidences of the higher bed are first noticed in the township road, and following the bench around the hill, the bed is found opened up on Hoover's land, measuring in the mine as follows (C. A. Young):

Bony coal and slate	1′ 0″	3′ 0″
Coal	2′ 0″	
Fire-clay ?.		

Schupstein Mine.—From this mine the hill slopes westward towards a small run, and near the edge of the water bed E was opened up by Mr. Schupstein, the drift starting with the outcrop of the coal, which shows about the same as in the Hugus shaft, as follows:

Slate.		
Coal	2′ 5″	3′ 8″
Slate	0′ 1″	
Coal	0′ 5″	
Slate	0′ 1″	
Coal	0′ 8″	
Fire-clay.		

This section shows the persistency with which the small slate partings hold their places.

Advancing south-west from this mine along the township road towards the west branch of Coxe's creek, the Freeport group continues to cover the hill tops, the outcrops of the coals forming evenly rounded terraces on the slopes.

About one mile south-west of Schupstein's mine, the road crosses the west branch, and on *Gillian Koontz's farm*, all of the Freeport coals are in the hills above water level.

The stratum of ferriferous limestone has here been found just above the bed of the creek; it is overlaid at a short distance by several feet of coal.

The Middle Freeport bed outcrops 40 feet higher, and the bench of bed E shows plainly some distance farther up the slope.

Ascending the hill on the opposite side of the creek, and continuing south-west, the outcrops of the Freeport coals are frequently observed in the road.

This brief sketch, imperfect though it be, will serve, nevertheless, to show the nature of the rocks which compose the west side of Coxe's creek, in the region of Somerset.

Descending the west branch of the stream, the Freeport coals are carried along until the ravine merges into the main valley, where boulders and fragments of the Freeport sandstone prevail.

Milford Station.

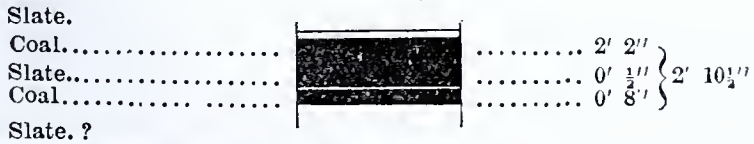
No further developments are there met with along the Somerset and Mineral Point railroad until near Milford station, at which place *bed B* is found above water level.

Ankeny Mine.—This coal has here been opened up at a number of points on the bank of the stream, and is at present mined by Mr. Geo. Ankeny, a short distance north of the railroad station. The mine is run in a north-east course into a high, evenly rounded bench, and rises slightly, but the dip to the north-west is also manifest. However, the steady sinking of the rocks to the south-west is noticeable in the few side cuttings along the railroad, and it is partly due to this steady sinking of the basin to the south-west that Coxe's creek is not far below the Lower Productive coals at Mineral Point. The mine is not very extensively operated, but a sufficient amount of coal is taken out to supply the wants of the railroad company and the farmers in the immediate neighborhood.

The coal burns easily, making a quick, hot fire, and produces little smoke; all this has been thoroughly tested in the railroad engine; but the coal is manifestly sulphurous, and the run of the mine is on this account rejected absolutely by the blacksmiths; a small portion of the bed, however, can, it is said, when carefully mined, be used in the forge.

The following section shows the thickness of the seam as far as exposed:

Fig 70.



It is not known whether this section represents the entire thickness of the bed, or whether another small bench of coal

may not underlie the slate constituting the present floor of the mine. Moreover, the thickness of the main bench was observed to vary considerably, and will average, perhaps, more coal than that represented in the above section.

On Ankeny's hill, a low bench shows some fifty feet above the mine, beyond which the country rises slowly towards the Negro Mountain axis.

Thirty feet below the mine, at the foot of a small bench, a side cutting on the railroad has exposed the smut of a thin, unimportant coal seam, underlaid at a short interval by five feet of sandstone.

This point is at the mouth of Laurel Run, a small stream descending from Negro Ridge westward into Coxe's creek.

Crossing the run, and proceeding about one-half mile south of Ankeny's mine, bed B is again seen opened up in two places near the base of a high hill which rises steeply from Coxe's creek.

Brandt Mine.—In one of these mines (known as the Brandt opening), an irregularity seems to have occurred in the measures about 250 feet from the outcrop of the bed. But the prevalence of noxious gases throughout the mine rendered impossible a close inspection of the opening in its present condition. The irregularity, as described, consists in a sharp rise of the coal, accompanied by an abnormal and unusual swelling of the bed to a thickness of eight feet. This thickness is maintained for a short distance, when the coal is said to disappear totally.

The information to be gathered respecting this occurrence is exceedingly meagre, and insufficient to warrant any definite explanation of the matter, but considering the entire regularity of the rocks on all sides of the mine, it does not seem probable that a fault, (in the strict sense of the word,) has occurred at this place, as has been popularly supposed, but rather that a sharp "horseback" has here intervened, on the flanks of which the bed appears unusually thick. A shaft put down from the top of the bench would serve to ventilate the mine, and probably discover the whereabouts of the lost coal.

It may here be noted that an irregularity, similar in many respects to the one above described, may be seen at Shoo Fly tunnel, on the Pittsburg division of the Baltimore and Ohio rail-

road, where an extensive rock cutting has most handsomely exposed the sudden thickening of a coal bed preparatory to a sudden abnormal dip. This occurrence is elsewhere described in detail.

Mr. Charles A. Young, of the Survey, measured the bed as it appears in the Brandt opening near the mouth of the drift. This measurement represents the normal thickness of the seam, and the section will be seen to correspond closely with that obtained in the Ankeny mine. It reads:

Slate.		
Coal	2′ 9″	3′ 7″
Parting	0′ 3″	
Coal	0′ 7″	
Fire-clay.		

The same bed was again opened further south on an adjoining property, but the mine is now completely shut. No trouble was here experienced.

Eastward the hill rises with tolerable steepness from the creek. A well defined bench is however observed about 100 feet (?) above the Brandt opening. The smut of the coal is plainly marked in the road along the foot of the bench, but the thickness of the bed has never been definitely ascertained. This is perhaps the outcrop of bed D.

Baker's Station.

Continuing south-westward along the railroad nothing is noticed, aside from the handsome bench of bed B, which keeps close to the water, until Baker's station has been reached, about one mile south of the point at which the "clay pike" crosses Coxe's creek.

At Baker's station the creek is confined to hills which rise 200 feet above the stream; these hills are wholly composed of Lower Productive coal measure rocks, and with the exception of the highest coal seam (bed E) include all limestones, fire clays, coals, ores &c., known to belong to this group as it appears throughout the region under discussion.

The developments hereabouts are chiefly confined to the *farm of J. D. Baker* the mineral rights of which are owned by Mr. A. Stutzman, of Somerset. Work has been begun here only very recently and little more had been accomplished (July, 1876), than to determine the thickness of the coals, which

were found to run about the same as at other points on Coxe's creek.

By the aid of these partial developments of Mr. Stutzman a section was construeted, whieh is here inserted for the purpose of showing the number of coal beds above water level at this plaee, together with the intervals by whieh they are separated. It extends from bed D′ down nearly to bed A, whieh is supposed to underlie the ereek by a few feet. The section is as follows:

Vertical Section at Baker's Station.

Hill top.	
Interval	10′ 0″
Bench, bed D′.	
Interval	35′ 0″
Coal, bed D	4′ 0′
Limestone.	
Interval from base of coal	16′ 0″
Fire-clay outcrop.	
Interval	35′ 0 ′
Coal, bed C	1′ 6″
Fire-clay with ore balls.	
Interval, from top of coal	from 45′ 0″ to 50′ 0″
Coal, bed B.	
Interval	50′ 0″
Coxe's creek.	
Total	201′ 6″

Bed B as opened by Mr. Stutzman, showed four feet of coal at the erop, but was exeeedingly irregular in point of thickness, thinning down rapidly to a few inches, when work in the gangway was diseontinued.

The same bed was worked for a number of years on the opposite side of the ereek, on the land of *Mr. William Baker*, where it yielded between three and four feet of eoal.

The mine was examined by Mr. Young, whose measurements of the bed agree almost preeisely with those obtained in the Ankeny and Brandt mines at Milford. The small slate parting, one of the most prominent features of the bed, was observed to run with great persisteney and regularity.

The bed then eontinues down the ereek, keeping above water level all the way, and is exposed at *Mineral Point* on the lands of Mr. P. Wolfersberger, a deseription of whieh will be found in a sueeeeding ehapter.

Bed C is here only known on the hillside, where the above seetion was made, and was there opened on aceount of the iron

ore known to underlie it. The ore deposit, however, so far as one may judge from the present developments, is of little practical value. This is due not so much to the character of the ore, as to the form of its deposit, being what is usually known as "ball ore."

The fire-clay band found between beds C and D is a persistent deposit throughout this region of country. It was traced along both sides of Coxe's creek for a considerable distance, having been partially exposed at a number of places. It has been opened up on the property of Mr. William Baker, nearly opposite the mines of Mr. Stutzman.

The bed is here three feet thick, maintaining this thickness as far as yet worked; but it is uneven in quality, and the deposit, so far as seen, cannot be relied upon for a strictly good clay, that is if the run of the mine be taken. But if the output of the drift undergo careful "picking" before shipment, a hard, smooth, pearl colored clay, doubtless well adapted for fire bricks, can be obtained without difficulty.

Resting at a short interval above the fire-clay is the *ferriferous limestone*, probably the best known stratum in the Lower Productive coal measures in Somerset county.

Pieces of the limestone have been taken from the roof of Baker's clay mine, and although the hill here rises sufficiently high to include the entire deposit, it has not yet been opened up. But it has been partly exposed on the opposite side of the stream by Mr. Stutzman.

It is more fully developed at the mouth of Coxe's creek, but its quality and adaptability for agricultural purposes have never been ascertained at Baker's station.

Bed D comes in almost directly above the limestone. In this region it is invariably a double bed of very irregular thickness. As opened by Mr. Stutzman, it shows its characteristic fire-clay shale parting, and measures about five feet thick from roof to floor. Of this, however, at least one foot must be deducted for the thickness of the parting.

The bed has never been mined in this vicinity, but is known to exist in Coxe's Creek valley, almost all the way from Som-

erset to the Castleman river. Here and there it has been eroded from the hills, but this seldom occurs.

Bed D'. 35 feet still higher, on Mr. Baker's hill, a well defined bench undoubtedly marks the outcrop of Bed D'. This is seen on both sides of the creek, but has never been explored. It continues south-westward nearly as far as Mineral Point, but sweeps eastward before reaching the Castleman river.

Ascending by the clay pike to the top of the western slope of Coxe's Creek valley, the country spreads out to the westward as a rolling plain, diversified here and there by shallow ravines, which widen and deepen towards Coxe's creek. The Freeport coals range along the top of this plateau, appearing in the several hollows, where their outcrops have been frequently opened up by the farmers. The lowermost coals, A, B and C, are not exposed in any of the ravines, and it is the Freeport group alone that furnishes in this vicinity the coal beds available above water level. Of this group the lowest member (D) is throughout the region decidedly the most important bed. This local superiority is attributable to the increased thickness of the seam, which here yields fully double as much coal as either of the other beds.

The developments are too few and too imperfect to enable it to be definitely stated how far westward this condition of things extends; it certainly prevails along the Castleman to the south, as confined to this sub-basin, and perhaps prevails in all the intermediate region, though this can only be verified by opening up the beds at various points along their outcrop lines in the valleys of Scrubglade run and Middle creek.

The section of the Freeport coals, obtainable along the clay pike resembles very closely the typical section of this group in the First Great Basin. Such slight variations as occur in the clay pike section are due, probably, to the defective leveling of the aneroid. It reads as follows:

Coal, bed E.		
Interval	20′	0″
Fire-clay outcrop.		
Interval	45′	0″
Coal, bed D'.		
Interval	20′	0″

Sandstone	20′ 0″
Black slates and shales	10′ 0″
Coal, bed D.	
Total	115′ 0″

Rhoads' Run.

The lowest bed of the group outcrops just above the waters of Rhoad's run, which crosses the pike about midway between Milford and Gebhartsburg. Both coal and limestone have been exposed at a number of points along the western bank of the stream. On the farm of *Mr. Tobias Myers* the limestone almost directly underlies the coal, as has been established by actual developments, a few hundred yards north of the pike, the deposit having been here quite extensively benched.

The coal is provided with very little cover, and the thickness of the bed has been much reduced in consequence of its close proximity to the surface. It dips steadily, though very softly, to the north-westward, and gains protection from overlying rocks in the direction of the incline, the country increasing slightly in elevation in approaching the Viaduct anticlinal.

The section at the T. Myers quarry is not characteristic of bed D, as developed in this region, except in so far as it shows the thickness of the fire-clay stratum separating the coal and limestone. Moreover, the whole of the limestone deposit is not above water level at this place, but it is stated that excavations have shown it to be full 7 feet thick, and parted thrice by thin layers of impure fire-clay shale, dividing it into bands of about equal thickness.

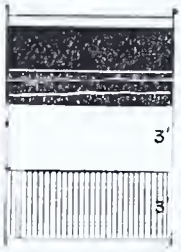
The same limestone was again opened on the other side of the pike, on land of *Mr. C. Boyts*, and still further south, on the same farm, both limestone and coal were quite extensively wrought, many years ago, near where the sugar camp now stands.

From the statements of those claiming to be familiar with these developments, it would seem that the coal is here at its normal thickness, though the dimensions of the bed cannot be given from actual observation, as the opening is now shut. The slates above the coal are 6 feet thick, and full as much limestone was taken out from under the coal; it was burned in a small kiln, and is said to have calcined easily, but yielded an impure, reddish lime.

Seibert Mine.—From 40 to 50 feet higher on the same hill bed D′ shows, the outcrop of which was once exposed, but has since been covered up. This coal is now mined on the Boyts farm, in an adjoining field to the north, and again on Jos. Seibert's land to the west. It is here nearly 3½ feet thick, being underlaid at a short interval by its usual attendant band of limestone. This limestone, 3 feet thick, is quarried by Seibert, producing a much purer lime than that obtained from the Lower Freeport deposit. Seibert's quarry marks about the centre of the basin, in so far as that point can be ascertained in this region without the aid of further and more complete developments.

The section of bed D′ is here as follows:

Fig. 71.



Heavy black slate.			
Coal, good	1′ 10″	3′ 5″	
Coal, bony	1′ 7″		
Fire clay	3′	3′ 0′	
Limestone	3′	3′ 0″	

The upper portion of the bed yields an excellent coal, which burns readily and leaves little ash. The bony portion of the bed is also taken out and used in calcining the limestone. It may fairly be questioned whether the above section represents the average condition of bed D′ in this neighborhood, for on Mr. Boyt's land the bench of bony coal is almost entirely replaced by good, bright, clean coal.

The line of outcrop of the bed passes between Boyts' orchard and house, keeping near the hill top, and shows in the pike just west of Rhoads' run, the Lower Freeport coal also outcropping in the road at water level, and forming there a distinct bench.

The Upper Freeport bed here comes in on the western bank of the run, its outcrop having been exposed by the grading of the pike. It is confined, however, to the highest land in the vicinity, and is quickly carried out into the air by the northwest rise of the measures towards the Viaduct anticlinal.

Continuing westward across the hill into the next ravine, a few imperfect rock exposures, which however serve to indicate the direction of the dip, are observed along the pike.

Bed D' comes to daylight near *J. Kimmel's house*, and was here opened up on land belonging to Mr. W. J. Baer, of Somerset. The coal was found to be nearly 3 feet thick. It outcrops on the opposite side of the ravine, and again crosses the pike further west in the eastern slope of the shallow valley of Scrubglade run. This is probably its final western outcrop in this sub-basin, preparatory to its crossing in the air the anticlinal arch near Centreville.

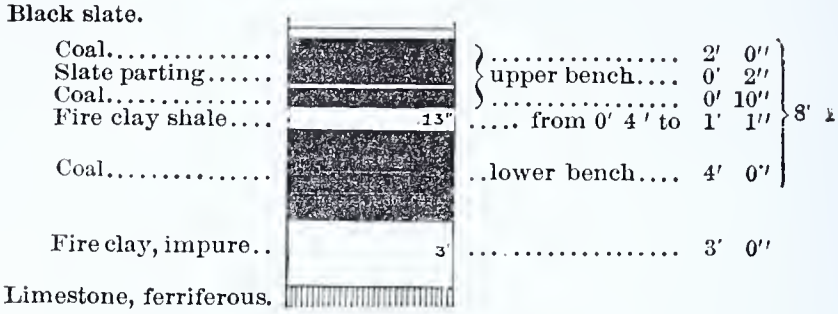
Bed D is above water level in the western bank of the run, having been handsomely exposed on the farm of *Jos. Myers*. It yields upwards of 7 feet of coal, parted near the centre by a band of fire clay shale. This band is of variable thickness, ranging from four inches to one foot, and on an adjoining property increasing to two feet thick and even more.

Throughout this region the swelling of the dividing shale is found to be attended invariably with a decrease in the thickness of the lower bench, the upper portion of the bed maintaining the same general height, and running with great evenness and regularity. Moreover the two benches of coal differ widely, both in point of structure and quality. The lower bench is firm, compact and bedded in horizontal layers; it is much intermixed with slate, possesses a dull lustre at the fracture and breaks up into blocks in mining. But in spite of its slaty character it is claimed that the coal produced from this portion of the bed is stronger and makes a hotter fire than that from the upper bench. This has been repeatedly tested in burning limestone, and it is asserted that the same amount of heat can be derived from one-third less of the coal from the lower bench.

The upper bench yields a much softer coal, of columnar structure. It carries a large amount of iron pyrites as "balls," and in small seams. The bench is unevenly divided by a thin but persistent slate band.

Meyers' Mine.—The following section was made near the working face of the mine:

Fig. 72.



The thickness of the limestone could not be ascertained, as almost the whole of the deposit is beneath the bed of the run.

The rocks here rise to the north-west at an angle of about 2°.

Bed D has also been opened on *Mr. Walker's land*, a short distance north of the pike. In this mine the parting shale between the two benches of coal is full 2 feet thick, and near Mr. Walker's house, where the same bed was again exposed, this shale is said to have measured nearly 3 feet in thickness.

About one mile north of the village of Gebhartsburg, the Lower Freeport coal is mined on two adjoining farms, bordering the run; the upper bench of the bed is alone worked, yielding in *Mr. Sechler's mine* nearly 3 feet of coal.

The Viaduct anticlinal crosses the pike at or near Centreville, but does not elevate the Pottsville Conglomerate to daylight. This rock remains concealed, however, beneath only a thin covering of Lower Productive coal measures, which may possibly include the lowest bed of the Freeport group. The rocks descend again quickly into the Johnstown-Confluence sub-basin, and the entire Lower Productive group of coals, including also a small amount of the Lower Barren Measures, are found about one mile west of Centreville.

The valley of *Middle creek* is composed of the same rocks which make up the valleys of Coxes' creek and Scrubglade run. The coals which come to daylight along Middle creek will, it is believed, be easily identified by adopting the ferriferous limestone and coal bed D as a basis. This limestone prevails along the valley, and has been opened in a number of places. Middle creek joins the Castleman River near Castleman station, on the Pittsburg division of the Baltimore and Ohio railroad.

CHAPTER X.

General Geology of the Castleman River Valley from the Negro Mountain Gap to the Turkeyfoot.

The Castleman river is one of the main arteries in the Somerset county drainage system; in point of size it is second only to the Youghiogheny, to which it is tributary, but considered economically, the region drained by it and its wide-spread branches is by far the most important portion of the county.

The course of the Castleman, in so far as it relates to Pennsylvania, is plainly indicated on the Somerset county map accompanying this volume; and by reference to this map it will be seen that the Castleman describes a wide loop, of irregular outline, thirty-five miles long.

It crosses the Mason and Dixon line a few miles south-west of Salisbury, and runs for nine miles nearly along the strike of the rocks. At Meyersdale it turns sharply to the north-west, maintaining this course, with a few minor variations, for about ten miles, which carries it through the high, massive ridge of Negro Mountain and as far beyond as Mineral Point, a small village lying at the western edge of the gap.

The river here touches its most northerly point, being 13½ miles north of the Maryland State line, an interval which becomes steadily reduced by its subsequent course.

At Mineral Point the Castleman bends south-west, and again runs, for full three miles, nearly parallel to the strike of the rocks, the measures exposed along the river consequently undergoing little variation. But from the mouth of Middle creek to Harnedsville, in the Johnstown–Confluence sub-basin, the course of the Castleman changes by sharp turns from due south to due west, excepting along the border of Upper Turkeyfoot township, where, just before crossing the synclinal axis of the Somerset sub-basin, the river sweeps south-eastward for nearly a mile,

winding around the flattened rocks to return again upon itself and recross the same strata, thus forming a narrow nose of high land less than one-half a mile in width. This narrow neck of land is Pinkerton Point, beyond which the river again runs south, but in returning by a north-west course is brought up against the ridge of the Viaduct anticlinal. Through this ridge it has cut a deep gap, enclosed by high walls and massively paved by the Pottsville (Seral) Conglomerate of No. XII. At Fort Hill it leaves the Viaduct axis, and runs nearly west as far as Brook tunnel, where it bends sharply and runs southward for a considerable distance; turns then and again flows west, holding this course for more than a mile, when by a graceful curve it makes its final sweep southward, getting within five and one-half miles of the Maryland line at Harnedsville; thence the river runs west and north-west to its junction with Laurel Hill creek and the Youghiogheny river at the Turkey-foot.

The geology of the Castleman river, as confined to the Berlin-Salisbury sub-basin east of Negro Mountain, is elsewhere described in detail in this volume. These results may here very properly be briefly recapitulated:

Firstly, it was shown that the river in that sub-basin flows mainly over rocks belonging to the Lower Barren Measure ure series, and that from the Maryland line, north-eastward as far as Meyersdale, the hills skirting the western bank of the stream attain sufficient elevation to include over a narrow area not only the Pittsburg bed of coal, but in places also as much as 200 feet of the Upper Productive coal measures; *secondly*, that this condition of things extends neither north nor west from Meyersdale, and that before entering the hills of Negro Mountain the river gets below the Barren Measure rocks, thus bringing to daylight the Lower Productive coal beds; and *finally*, that before crossing the Negro Mountain anticlinal the channel of the Castleman is far down in the sub-Conglomerate rocks.

Crossing this anticlinal, it enters the Somerset sub-basin, which it leaves at Shoo Fly tunnel, passing at that point the arch of the Viaduct axis, the western geological boundary line of the Somerset sub-basin. For the balance of its course it

flows in the Johnstown-Confluence sub-basin, crossing the synclinal of the basin before mingling its waters with those of the Youghiogheny.

The Castleman river, from Mineral Point to the Turkey Foot, flows through a typical coal measure valley. The changes that occur in the geology are few in number and simple in character, but their effect on the topography and the general condition of the valley, is as immediate as it is imperative.

These changes consist merely in a gradual replacement of the Lower Productive coal rocks by the softer material which in large part makes up the Lower Barren Measures, while the effect produced is to convert steep, rugged and forbidding hillsides into gentle slopes, which permit of a profitable cultivation of the soil. Wherever the Lower Productive coal rocks prevail, to the exclusion of all higher measures, there the valley is wholly unattractive to the farmer, who has naturally sought the high glade land to the north; but these unprepossessing hillsides include several beds of coal and fire-clay, besides carrying, very frequently, an important band of iron ore, and are therefore of much importance economically.

When the conditions are favorable to an accumulation of Barren Measure slates and shales on top of these Lower Productive rocks, the change in the general face of the country, though gradual, is both interesting and striking. And though the change is invariably the same, in all regions, wherever similar conditions prevail, yet it is most handsomely illustrated in the Castleman valley, where the hills are high and the changes plainly marked.

Excepting at the centre of the respective troughs, the Castleman valley is still a wilderness. This is mainly due to the great prevalence of heavy sandstone beds, the boulders and angular fragments of which often extend from the channel of the river to a point far up on the slopes. These sandstone masses proceed from three distinct deposits, differing in thickness, but equally massive; namely, the Pottsville (Seral) Conglomerate, at the base of the Lower Productive group, the Freeport sandstone overlying coal bed D, and the Mahoning sandstone overlying coal bed E, at the top of the group. The

places occupied by these deposits at different parts of the valley, are enumerated further on.

It was stated above that at the centre of the Negro Mountain anticlinal, the Castleman river flows over sub-Conglomerate rocks. In descending the river from Pine Grove station, at which point the Negro Mountain anticlinal axis crosses the Castleman, these sub-Conglomerate rocks, several hundred feet thick, disappear rapidly beneath the water, under the influence of a sharp north-west dip, and before the west end of the gap has been reached the Pottsville Conglomerate (XII) has also been buried, thus allowing the coal measures to come into the hills. Thus far (Mineral Point) the few exposures along the railroad show almost nothing, and the thicknessof either XI, (Mauch Chunk red shale,) or XII, (Pottsville Conglomerate,) can only be approximately determined. But portions of the Lower Productive series are above water level along the Castleman river for the balance of its course, the local sections grouped on Page Plate XI showing how much of these measures are above water level at the various places where sections were made; while out of these local sections, a vertical section has been compiled (Page Plate X, Fig. 73) which is nearly complete to a point 100 feet above Bed E, the highest coal of the Lower Productive group. Before the Turkey Foot is reached the Lower Productive rocks support as much as 370 feet of cover, which is nearly two-thirds of the entire Barren Measure series.

This section is of much geological importance, the Castleman valley being the most southern point in the First Great Basin of Pennsylvania, where a full section of the Lower Productive coal rocks is obtainable. And it further completes the series from the Susquehanna river to the Maryland line, establishing, along with the others, the singular regularity with which these measures run in this Basin.

The section is similar to those made in Clearfield, Cambria and Centre counties to the north, not only in its main features, but it also shows a remarkable resemblance to them even in its minor details. Placed side by side with the leading sections of the north, the differences noted are trifling, with one single exception; and this exception, the introduction of the ferrifer-

ous limestone into the section and the thickening of coal bed D, occurs in Cambria county, and was discussed in the Report of Progress on that district*, and is more fully elaborated in the final chapter of this volume.

The identification, therefore, of the coal beds of the Castleman valley with beds elsewhere in the First Basin, occupying similar horizons, is attended with but little difficulty. The six persistent seams, A, B, C, D, D′ and E, that have been followed step by step from the Susquehanna river south-westward, occupy their accustomed place in the Castleman section, separated by almost precisely the same intervals, which in turn are composed of very nearly the same rocks.

Castleman River Section (Compiled).

The Castleman section is shown on Page Plate X; it reads as follows (Fig. 73):

Coal smut	0′	3′
Fire clay shale	1	6
Coal smut and black slate	1	0
Limestone	10	0
Shales	35	0
Black slate crop	2	0
Shales	18	0
Sandstone	20	0
Shales	25	0
Coal	1	6
Interval	160	0
Coal, Rose bed	6	0
Olive shales	20	0
Sandstone, flaggy, with ore ball stratum	25	0
Shales	15	0
Sandstone, flaggy	20	0
Black slates and shales	25	0
Coal, bed E	2	0
Fire-clay shale	0	7
Limestone	3	6
Interval	60	0
Coal, bed D′	1	6
Shale	1	0
Limestone	3	0
Interval	10	0
Sandstone, Freeport	20	0
Black slates	6	0
Coal / Fire-clay shale. / Coal — bed D, 6′ 6″	4	6

* Report of Progress HH, Harrisburg, 1875.

Slate	1′	0′
Limestone, ferriferous	6	0
Fire-clay, with ore	4	0
Interval	20	0
Coal crop (?).		
Interval	2	0
Limestone	3	0
Interval	6	0
Sandstone	8	0
Black slate with thin band of ore	8	0
Coal, bed C	1	6
Fire-clay	4	0
Sandstone	4	0
Black slate	11	0
Coal	0	6
Fire-clay, with ore balls	3	0
Black slate	7	0
Coal, bed B	4	0
Fire-clay	1	0
Shales, with ore balls	17	0
Sandstone	10	0
Coal	1	6
Shale	5	0
Sandstone	3	0
Slate and shale	14	0
Sandstone	25	0
Coal, bed A	3	6
Impure fire-clay	20	0
Sandstone, Piedmont	30	0
Coal	1	0
Pottsville Conglomerate.		
Total	723′	4″

The Lower Productive Measures.

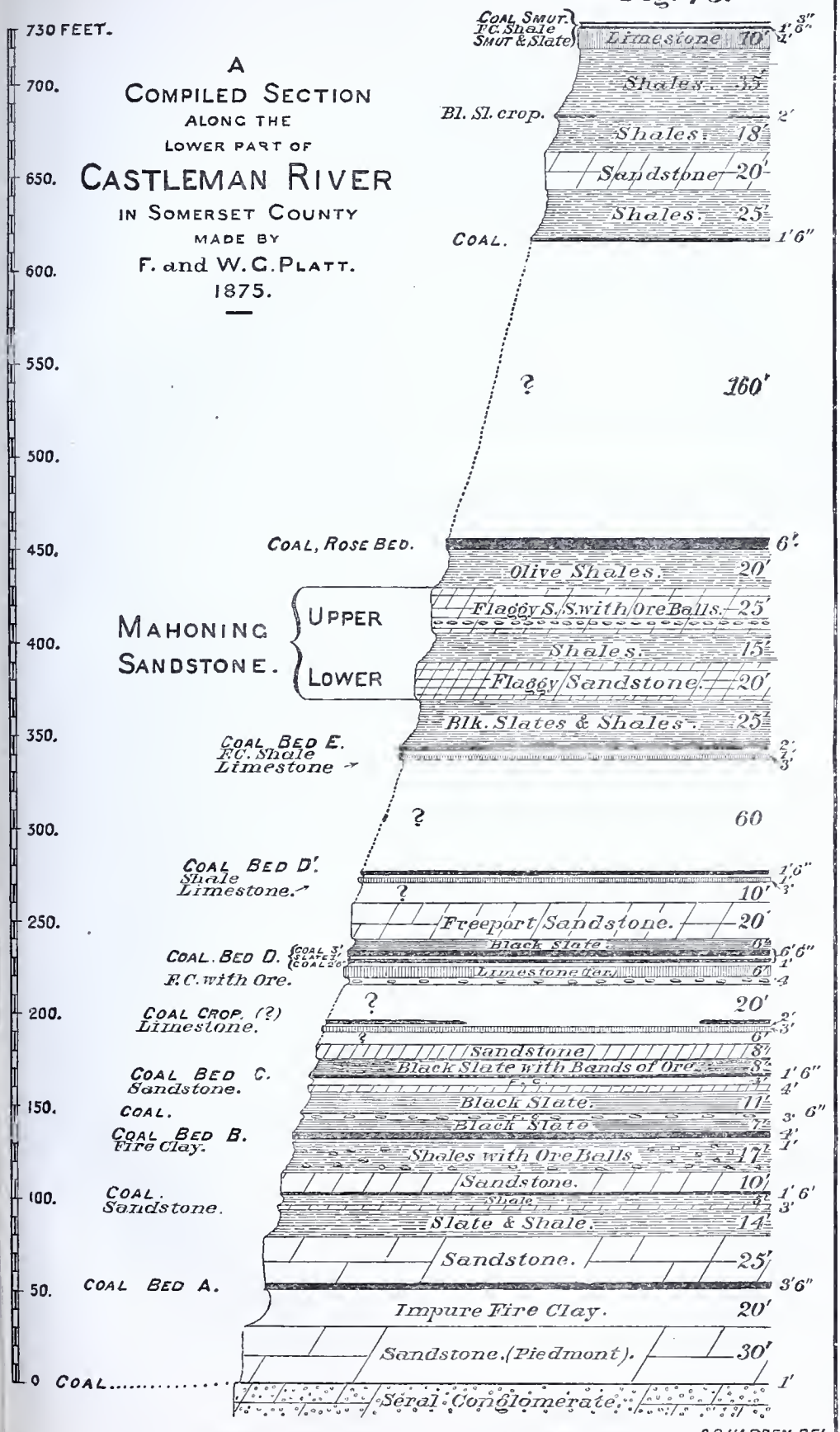
In analysing the Castleman section more closely, we find that *coal bed A*, with its underlying mass of impure fire clay shale, shows in the measures just above a deposit of heavy sandstone, the Piedmont sandstone, or the upper portion of the Pottsville Conglomerate, (No. XII,) the name Piedmont being derived from the Cumberland basin.

The fire-clay deposit, seen below bed A at Shoo Fly tunnel, is an almost unfailing accompaniment of the seam. It is, however, unusually impure and abnormally thick at the above locality.

There has been no attempt to work this clay at any point along the Castleman River, though it is everywhere present wherever its horizon is above water level, and is of considerable thickness.

Fig. 73.

A COMPILED SECTION ALONG THE LOWER PART OF CASTLEMAN RIVER IN SOMERSET COUNTY MADE BY F. and W. G. PLATT. 1875.



O. B. HARDEN. DEL.

This is probably the most persistent and important fire-clay deposit in the coal measures. The previous Reports of Progress, (H, 1874, and HH, 1875,) in Cambria, Clearfield, Centre and Jefferson counties, give numerous measurements and analyses of the bed in the different localities; the well known firebrick works at Sandy Ridge, Blue Ball, Woodland and Hope Station, in Clearfield county; Benezette, in Elk county; Brookville, in Jefferson county, and Queen's Run and Farrandsville, in Clinton county, all derive their fire-clay from this bed.

The coal bed runs about $3\frac{1}{2}$ feet thick, and is obviously impure, although as worked opposite Castleman station it is reported to have given entire satisfaction. A sudden and sharp horseback, by which the coal is sent rapidly downwards, is shown in the cutting at Shoo Fly tunnel. This irregularity is highly interesting, and is more fully described and illustrated (Page Plate XII, Fig. 81,) in the detailed description of that region.

The sandstone which appears in the section as directly overlying bed A, is one of the governing sandstones of the Lower Productive coal measures. It is persistent over wide areas, and is an excellent guide to the identification of the two lowest workable coal beds of the series. Along the Castleman river it is made up of minute grains, cemented closely and firmly together, the whole possessing a grayish color. It varies considerably, ranging from a few feet to thirty feet in thickness. At Shoo Fly tunnel it is full 25 feet thick, and crowds out the slates which almost invariably rest upon bed A.

Bed B is placed 80 feet above bed A in the Castleman section. This distance is possibly somewhat exaggerated, but it is believed to be very close to the truth. An opportunity was not afforded for an exact measurement of the interval between the beds, and though perhaps a trifle wide of the correct figure, 80 feet must be accepted as the nearest approach to absolute accuracy that can at present be obtained in the absence of further developments.

Very little, however, is known of the character of this bed in the Castleman valley, and there seems to be good reason to believe that it is of little importance economically throughout all this region. Otherwise it would have been more frequently

developed, for its existenee is not unknown at various points along the valley. Little dependenee ean therefore be plaeed upon it for a supply of good marketable eoal, although more systematie and thorough developments, by whieh its quality may be tested ehemieally and its thiekness proved, may show that the bed is valuable either for steam or eoking purposes, and that the few imperfeet openings that have hitherto been made in it from time to time, do not faithfully express the real eondition of things.

Bed C, or rather the small seam that has been known as bed C throughout the Clearfield and Cambria reports, is seen in the Castleman eolumn oeeupying a position 30 feet above bed B. This is its usual plaee, and along the Castleman the eoal is 1 foot 6 inehes thiek, with a regular roof and floor. A small band of earbonate iron ore is usually found in the roof slates. This band, though rich in iron, does not exceed 2 inehes in thiekness, and is therefore too small to be of any praetical importanee.

An altogether new feature of the Castleman seetion is the oeeurrenee of a *small limestone band* about 20 feet above bed C. This was observed in a single loeality, but its horizon is unmistakable. It is about 3 feet thick, and seems overlaid at a short distance by a thin streak of coal.

Bed D.—The next eoal bed in aseending order is, so far as we may judge from the faets at hand, the most important deposit of the Castleman valley. And this it owes to its superior thickness, yielding nearly double as mueh eoal as any of the other beds of the Lower Produetive series, and also to its association with a deposit of limestone 6 feet thiek, rather than the purity of the bed, for freedom from impurities eharaeterizes neither the eoal nor limestone throughout the valley. But though somewhat slaty and pyritous, the eoal is easily mined and is suitable for domestic purposes; and while the limestone earries both iron and magnesia in eonsiderable quantities, there is an abundanee of strong fuel at hand to give it the hard burning it requires.

The eoal bed is here easily reeognized and identified. Its assoeiation with the ferriferous limestone, almost directly underlying, and with the massive Freeport sandstone, almost di-

reetly overlying, would alone render it recognizable; but the thiek band of impure fire elay shale, which divides the bed unevenly into two benches, is an unfailing and unerring guide to its identification along the Castleman.

This parting reaches its maximum thickness in the Castleman valley; elsewhere in this volume it was shown that the parting does not occur at all at the extreme northern end of the county, nor does it appear in Cambria county; but that it first shows as a thin streak of slate, which slowly thickens southwestward into a band of indurated fire-elay shale one foot thiek, and sometimes of even greater dimensions.

The Freeport Sandstone occupies a position between coal beds D and D′. This deposit, though of variable thickness, is recognizable over wide areas, and establishes a marked horizon in the Lower Productive coal measures. But the massiveness of the deposit along the Castleman gives to it unusual prominence throughout the valley. Its outcrop is frequently marked by bold cliffs, twenty feet high, ranging along the brow of an abrupt hillside, while at other times it makes its presence known by loose masses of heavy sandstone, which exercise a blighting effect upon the cultivation of the soil.

The physical features of this sandstone deposit are very prominent along the Castleman. It has a somewhat pebbly character, the pebbles being usually elongated and about as large as a bean. Under atmospheric action the sandstone weathers into rounded blocks, bleaching on the weathered side, and bringing the isolated pebbles into bold relief. It is thus easily mistakable for the Pottsville Conglomerate.

The Middle Freeport coal bed comes in a short distance above the Freeport sandstone. The bed is little known between Mineral Point and the Turkey Foot, and is therefore absent from the majority of the local sections. But its absence must not be understood as indicating that the bed has disappeared totally from the series; it is doubtless represented on the Castleman in all the hillsides which include the Freeport group, but has remained unexplored. The bed is usually too thin to be wrought with profit even for domestic purposes, and it is therefore, as a rule, only exposed at those points where it is known to be underlaid by limestone. It is so represented in the Cas-

tleman section, although this is only partly established by the few and imperfect openings on it seen along the river. It is not known at all in the Fort Hill and Harnedsville regions, and in fact has not been recognized anywhere along the Castleman in the Johnstown-Confluence sub-basin. Its discovery at any point between Fort Hill and the Turkey Foot, or in the neighborhood of Ursina on Laurel Hill run, would be very gratifying and would clear up considerable that can now only be explained by conjecture.

The small coal and limestone which range through the hills about 110 feet above bed D, or the Ferriferous coal, clearly belongs to the *Upper Freeport* deposit. Otherwise it must be assumed that a sudden thickening has occurred in the measures whereby the Freeport group has swelled to thrice its usual dimensions, and that too within a short distance, for no such thing is known at Somerset, where the rocks of this group are entirely normal, nor is it the case along the clay pike only a few miles north of the Castleman, as has been shown in a previous chapter.

Moreover, the usual interval between beds D and E is 110 feet, an interval which prevails, with only trifling variations, from the Snow Shoe district, in Centre county, to within a few miles of the Castleman river.

Assuming, then, that this be the Upper Freeport coal bed and that the Middle Freeport coal still remains unexplored along the Castleman river, the section, so far as it relates to the Lower Productive Measures, is complete. The Upper Freeport bed lacks significance, economically considered, owing to its attenuated condition. It is, however, underlaid by a moderately pure limestone, which calcines easily, and yielding a fair, good lime, is always of much importance to the farmers.

The Upper Freeport bed is regarded as the top of the Lower Productive coal series, the Mahoning sandstone coming in directly above and forming a massive roof, on which the "Lower Barrens" rest. From the preceding pages it is manifest that no just estimate can be formed of the quality and thickness of the Lower Productive coals in the Castleman valley from the few imperfect openings that have hitherto been made. And this fact is even made more manifest by the detailed descrip-

tion of these scattered developments given in a succeeding chapter.

It is, however, plainly apparent that the work of development along the Castleman, so far as this has yet been carried, indicates that the Lower Productive coal seams are thinner and more parted in that locality than in other regions; but it is also certain that there is an abundance of coal above water level in this valley, the adaptability of which, either for coking or steam purposes, remains a question for future determination.

Castleman Valley Iron Ores.

The iron ores of the Castleman valley have hitherto been much neglected, and very little is known respecting them. Both the Castleman station and the Pinkerton Point sections show a workable band of carbonate ore between beds D and E, and traces of the Johnstown ore deposit are seen in the higher sections which extend up into the Barren Measures.

The upper ore outcrop is perhaps of little consequence, but the Pinkerton Point deposit has been investigated, and has been shown to be a persistent band, rich in iron. The iron ore band high above the water level at Castleman station, is doubtless the same deposit.

Traces of the Hooversville deposit, (between beds A and B,) likewise appear in the Castleman station section, and also in some other of the local sections. But these traces, (except at Castleman station,) are so feeble that they amount to little or nothing.

The Shade Furnace and Listonville ore, on the Pottsville Conglomerate (XII), is missing altogether from the section under consideration. It is just possible that this absence is attributable rather to a lack of proper exploration than to any other cause, though considering the unreliability of such ore deposits over extended areas, it is also possible that the ore band, so well known at other localities, has so decreased in thickness as to be scarcely recognizable along the Castleman river.

The Lower Barren Measures.

The Barren Measure portion of the Castleman section requires some especial notice. By reference to the section it will

be observed that as much as 380 feet of these rocks are included in the hills, the highest point being reached at the synclinal of the Johnstown-Confluence sub-basin; but they are also found along Laurel Hill creek from Ursina westward, and along the Youghiogheny from Confluence southward, for a considerable distance.

The Mahoning Sandstone, as a double deposit, parted by a mass of shale 15 feet thick, is prominent in the Castleman section, as it is in nature along the river.

It does not rest immediately on top of the Upper Freeport coal bed, as frequently happens, but is separated from it by a deposit of soft black slates and shales 25 feet thick.

The sandstone is much current bedded, which causes it in weathering to break up into small pieces. It thus often covers the slopes, along which its outcrop line runs, with plates and fragments of fine-grained sandstone, often mottled with spots of the oxide of iron.

The Johnstown iron ore is seen resting on top of the sandstone deposit, but as it occurs in the form of loose nodules and balls, it lacks significance, except as testifying to the persistency of the iron ore horizon.

The Rose coal bed is an important feature in the Barren Measure portion of the section. This bed occurs about 100 feet above the Upper Freeport coal, but like all coal beds and especially all coal beds in the Barren Measures, its thickness varies considerably even over small areas.

It must not be understood therefore as averaging 6 feet thick along the Castleman river, nor even approaching that figure. It is so represented in the Castleman compiled section merely to avoid confusion, for the bed has gained considerable notoriety through the operations of the Pittsburg Coal, Coke and Iron Company, by which company it was opened on Brown's run, north of Ursina, full six feet thick, a thickness it totally fails to maintain. So far as opened along the Castleman, it is of no importance whatever, although the developments have shown that the bed runs with great persistency, coming in always about 100 feet above bed E.

A few thin streaks of coal occur at various intervals between the large bed and the topmost limestone of the section. These

are not workable deposits, and are therefore entirely devoid of interest economically, but a complete section of these small beds, together with the intervals separating them, is of scientific interest.

The highest limestone, capping the section 380 feet above the Upper Freeport coal bed, is clearly the *Elk Lick limestone*, and has been so identified elsewhere in this Report. Indeed it is this section, with its topmost limestone, that furnishes the link in the Barren Measure chain that was unobtainable in the Berlin-Salisbury sub-basin, the link establishing the connection between the Elk Lick limestone and the top of the Lower Productive coal measures.

The limestone is further seen to be accompanied at Harnedsville, Ursina and Confluence by its attendant coal bed, the *Elk Lick coal*, but as the limestone usually forms the summit of the high plateau, only a trace of the original coal bed remains. At one point, in Lower Turkey Foot Township, sufficient cover has been spared to allow the coal bed to appear at its full height, namely, 2½ feet.

Including the sub-Conglomerate rocks in the Negro Mountain gap, fully as much as 1,200 feet of measures are exposed between the surface of the Castleman river at Pine Grove station, and the top of the highest ground at Confluence. Though exposed in the sense of affording an opportunity for a measurement of interval distances, yet all of the different strata cannot be seen, being covered up by surface soil and debris, and the complete descriptive section comprehends only about two-thirds of the whole amount of included measures. Along the railroad, (Pittsburg Division of the Baltimore and Ohio Railroad,) which skirts the north bank of the stream from Brook Tunnel to Meyersdale, partial sections are occasionally offered, the show in a few instances being very handsome, notably near Castleman station, and near Shoo Fly tunnel, but in the main, the railroad is located close to the river, and thus avoids much cutting.

This railroad, connecting the Castleman valley with the east and west, has already been in active operation for a number of years. But the road has awakened little activity in the valley, excepting in the Meyersdale region, which has reaped all the advantages of possessing the famous Pittsburg coal bed. And

that this great bed should monopolize attention need create no surprise. The smaller coals of the Lower Productive series, even supposing that they should prove to be highly valuable, can scarcely expect to be extensively worked for shipment until the greater part of the Meyersdale-Salisbury area has been developed.

CHAPTER XI.

Description of Mines and Mineral Developments on the Castleman River, in the Somerset Sub-Basin.

A discussion of the coal measures along the Castleman river in the Somerset sub-basin, properly begins at Mineral Point, where nearly the entire group of Lower Productive rocks is above water level. This place marks the western end of Negro Mountain gap, the high precipitous sides of which are almost wholly composed of Formations XII, XI, and perhaps a portion of No. X. Formation XII, the Great Pottsville or Seral Conglomerate, crowns the mountain top where it overlooks Pine Grove, at the centre of the gap, and the lofty walls of rock and shale, 700 feet high, which enclose the river at this point, are entirely destitute of workable coal seams. But on the mountain top, to the north of the stream, a thin sheet of coal measures stretches almost to the summit of the axis, and carries with it the lowest workable bed of the series, *bed A*.

This seam was discovered on the *Vogel farm* high above the Castleman, and only a short distance west of the centre of the anticlinal arch. Where opened the coal is near its final eastern crop, preparatory to its crossing the arch in the air, and the bench of the bed is quite prominent, ranging over the highest fields of the farm.

The bed was only recently opened, and is claimed to measure 6 feet thick; the coal is considerably intermixed with slate, besides carrying some sulphur, but is sufficiently pure for domestic purposes, and its discovery is of geological importance as defining the limits of the coal measures on Negro Mountain at this point.

The line of junction between the coal measures and the Conglomerate is very plainly marked, the smooth tillable soil from the softer rocks of the coal measures being here under cultivation, and presenting a striking contrast to the sterility existing along the outcrop of the Conglomerate.

In going north-westward from the Vogel farm towards Mineral Point, the coal measures are observed to pile up rapidly, and bed A is soon lost beneath the surface after leaving the Vogel mine. Its outcrop descending sharply south-west, runs along both sides of the gap, keeping high above the Castleman for some distance. It is here, however, concealed from view; nor is it seen at the place where it passes under water level, about one-third of a mile south-east of Mineral Point station, so that its thickness there is unknown.

Just beyond the point where this coal bed is supposed to pass beneath the Castleman, the railroad cuts through a short nose of sand-rock projecting into the river. This sandstone, fine-grained and much current bedded, is presumably the well known deposit overlying bed A. Directly above this, two trial openings are seen, disclosing *beds A′ and B*, about 25 feet apart.

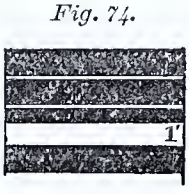
The openings were made by *Mr. Philip Wolfersberger*, by whom a thickness of full 2 feet is claimed for bed A′. This seems to be a distinct and well defined bed throughout the Lower Coal Measures, though usually too thin to be of practical value. It is 1′ 8″ thick at Bennington, (on the Allegheny Mountain,) and is at the latter place 34 feet below bed B.

From the Wolfersberger opening it sinks slowly towards the Castleman, and is just above the water's edge at Mineral Point station, at which place the hill rising to the north of the river has been thoroughly developed by Mr. Wolfersberger, and a tolerably complete section thereby afforded.

Wolfersberger Mine.—In ascending this hill a stratum of dark fire-clay shale, full 10 feet thick, is first seen, coming in directly above the railroad. Ten feet still higher *bed B* outcrops, and at this place a drift was run in upon it from the Coxe's creek side. The coal shows reasonably well, appearing as a double bed, about $4\frac{1}{2}$ feet thick, of which about $3\frac{1}{2}$ feet are good coal.

The gangway was driven in some distance on a south-east course, and sinks in that direction from the start, which indicates a slight horseback, as the measures are seen to rise regularly to the south-east, just beyond the face of the mine. Only a small amount of coal was taken from this opening, but such as was here mined is reported to have given satisfaction to those by whom it was used. The following section of the bed was obtained by Mr. Chas. A. Young:

Fig. 74.



Slate.			
Coal	1' 0"		
Slate	thin.		
Coal	1 0		
Slate	thin.	4' 6"	
Coal	0 6		
Fire-clay shale	1 0		
Coal	1 0		
Fire-clay.			

The thin slate partings noticed in the upper bench are believed to be non-persistent, and Mr. Young states that the coal is clean, bright and very free from sulphur.

Continuing the ascent of the hill, a stratum of dark colored, ore bearing shales, shows 25 feet above the mine. The shales are upwards of 6 feet thick, but so far as exposed by Mr. Wolfersberger the "ore balls" do not lie contiguously, and the outcrop is not promising. A few feet above this is a small coal bed, 18 inches thick, overlaid almost directly by a thin plate of carbonate iron ore. The coal is in position for *bed C.*

The ore shows well, but the band does not seem to attain a thickness exceeding 2 inches, and alone the deposit is therefore without value.

Fifteen feet above this outcrop, a deposit of sandy ferruginous shales, 6 feet thick, has been exposed. These shales are darkly stained with iron and are highly ferruginous, but seem, so far as one may judge from the present exposure, to carry little or no ore. Twenty feet still higher, Mr. Wolfersberger opened up the fire-clay deposit which almost directly underlies the ferriferous limestone. This fire-clay is worked on Coxe's creek, near Baker's station, and is elsewhere described (p. 169).

The *ferriferous limestone* and *coal bed D* have further been exposed on Mr. Wolfersberger's property. The limestone was quarried many years ago and calcined in a kiln, now in

ruins. It yielded an impure lime, adaptable, however, for fertilizing purposes. The whole of the deposit is no longer exposed on this hillside, but it is claimed to measure 5 feet thick.

The coal bed, which comes in almost directly above the limestone, is parted by a thick band of indurated fire clay shale, the entire bed from roof to floor measuring 6 feet in height.

A cliff of massive sandstone (Freeport) caps the hill to the north of the station, and *coal bed D'* does not extend to the river bluff, but is found further north, where the hill rises sufficiently high (so it is claimed) to include *bed E*, which must, however, only touch the tops of a few detached knolls. These coals appear, however, in the Mineral Point section, represented on Page Plate XI, Fig. 75, this portion of the section being compiled. In detail it is as follows, reading downwards:

Vertical Section at Mineral Point.

Coal, bed E	4′	0″
Interval	60	0
Coal, bed D′	2	0
Fire clay	2	0
Limestone	2	0
Interval	14	0
Sandstone (Freeport)	20	0
Coal, Fire clay shale, Coal — bed D	3	0
	1	0
	2	0
Slate		?
Limestone (ferriferous)	5	0
Fire clay	3	0
Interval; sandstone boulders	20	0
Shales, sandy and ferruginous	6	0
Interval	10	0
Shales, with *iron ore band* two inches thick	5	0
Coal, bed C	1	6
Interval	5	0
Shales, with ore balls	5	0
Interval, sandstone (?)	20	0
Slate		?
Coal, bed B	4	6
Fire clay		?
Interval	10	0
Fire clay shale	10	0
Interval	5	0
Coal	2	0
Water level of Castloman river.		
Total	222′	0″

The Freeport sandstone is very prominent at Mineral Point. To the north and east its outcrop ranges along the top of the hill in the form of a bold cliff, 20 feet high, from which, in weathering, boulders of great weight have become detached and rolled down the slope, which, in general appearance, is not unlike a hillside composed of No. XII, and might easily be mistaken for such, so heavy are the boulders, so massive the sandstone, and so sterile and barren the soil. It may be added, however, that the Freeport deposit, while furnishing a large amount of the sandstone at Mineral Point, is not alone responsible for all the boulders and fragments seen there, for not only the deposit between beds A and B, but also the Piedmont sandstone, and even the Great Conglomerate, have contributed each a considerable amount of broken sandstone, the boulders in the case of the Conglomerate having been carried by some agency from the interior of the gap.

Descending the Castleman from Mineral Point, rugged hills, enclosing the coals above described, skirt the stream on both sides. The course of the river carries it somewhat deeper into the basin within the next three miles, but the rapid fall in the Castleman amply compensates for the incline of the rocks towards the synclinal, and the measures above water level remain, therefore, nearly the same as far as Castleman village, in which interval there are few or no exposures to record as existing along the river hills.

Bed B was, however, at one time opened and worked to a small extent at *Schaff's bridge*, about one-half mile below (S.W.) Mineral Point station. The bed, which was opened 40 feet above the river, is said to yield here as much as 4 feet of good coal. The hill stretching south from the river has a gentle slope, and shows a succession of rounded terraces, all of which remain as yet unexplored.

At the *mouth of Middle creek* a high, evenly rounded terrace, consisting mainly of massive sandstone, but including also two thin coal seams close together, is conspicuous in the northern bank of the Castleman. This bench, only a few feet above the water, runs parallel with the railroad for some little distance, but is subsequently cut through, and in this manner its

contents have been exposed. Moreover, this cutting, which continues along the north side of the railroad for several hundred yards, reveals very prettily such a roll as coal beds, large and small, are frequently liable to. The irregularity is in the nature of a gentle wave, arching gracefully, the coals riding over the arch and suffering no change until the end of the cut, when the upper of the two small beds thins out and disappears totally, black slate coming in to take its place. This disappearance, however, is perhaps only local, for twin coal beds, believed to be the same as the above, were observed some distance further west.

These small coals occupy a position far down in the Lower Productive Series, and the outcrop lines run up Middle creek, but were not followed to their turning point on the latter stream.

At the mouth of Middle creek the hills are very high, especially to the south of the Castleman, where they rise full four hundred feet into the air, thus including all of the Lower Productive coal rocks, and a small portion also of the Barren Measures. Some of the coal beds have been opened at this place, on the property of *Mr. B. Heinbach*, but the openings are imperfect, and a more complete section can be obtained further down the river, opposite Castleman village, where a high, abrupt hillside facing the village from the south, has been quite thoroughly explored, with the following results (Page Plate XI, Fig. 76):

Vertical Section at Castleman Village.

Hill top, Mahoning sandstone.		
Shale	50′	0″
Ore ball stratum in shale.		
Shale	45	0
Sandstone	25	0
Interval, unknown rocks	30	0
Coal crop	2	0
Interval	10	0
Fire clay and black slate	3	0
Interval	19	0
Iron ore (?) limestone ?	2	0
Shales	43	0
Coal	2	10
Coal, bony		
Fire-clay, bed D	4	0
Coal	3	4

Fire-clay	3′	0″	
Limestone	2	0 +	(?)
Fire-clay and ore balls	3	9	
Interval	25	0	
Coal crop.			
Interval	3	0	
Limestone	3	0	
Interval	5	0	
Sandstone	18	0	
Coal	2	0	seen.
Fire-clay	3	0	
Interval	10	0	
Fire-clay	3	0	
Sandstone	35	0	
Coal	1	0	
Sandstone and fire-clay shale	4	0	
Black slates	8	0	
Coal	0	6	
Shales with ore	1′ 0″ to	6	0
Interval	25	0	
Fire-clay with ore	5	0	
Sandstone	10	0	
Coal	1	2	
Fire-clay, impure	3	0	
Black slates and shales	7	0	
Coal,	1	6	
Slate	0	2	
Coal,	1	6	
Fire-clay		?	
Interval	10	0	
Castleman river.			
Total	438	9	

Attention should properly be directed to the few points of difference existing between the Mineral Point and Castleman sections.

These two sections, drawn to scale, have been placed side by side on Page Plate XI, and the reader is therefore in position to note the nature and extent of the differences.

It seems reasonably certain that *bed A* is at the base of the Castleman section, although this identification has been made with some hesitation, but otherwise it is difficult to account for the wide interval between the Ferriferous coal bed (D) and the bed just above water level at Castleman village. The river is here from 50 to 60 feet lower than at Mineral Point, which would account for the increased depth of the section, providing the rocks occupy about the same level at both places, which is not improbable.

Beyond the mere opening up of the outcrops scarcely any-

thing has been done in the way of development at Castleman village. But in the back country to the east, and also to the north looking towards Centreville, on the clay pike, a number of openings, principally on *bed D*, have been made by farmers.

These mines are worked to a limited extent, and the openings are often very imperfect, but the thickness and character of the coal mined can in every instance be obtained.

The openings on the *B. Heinbach* property, one-half mile north-east of Castleman village, are now nearly all closed up. Indications would point, however, to bed D having once been mined here, at a height of 200 feet, by barometer, above the river. So long as the mine remained open considerable coal was taken from it, but it subsequently fell shut and was abandoned. The bed is reported as full 3 feet thick, and at the crop is considerably intermixed with slate; it burns freely, igniting quickly but leaves a large amount of ash. It is overlaid by crumbly shale, and the character of the floor could not be ascertained. It is highly probable that only one bench of the bed was mined.

Accepting this identification as correct, the *Middle Freeport limestone* comes in 50 feet higher in the hill. Only the extreme outcrop of the limestone has been exposed, and no coal was noted in connection with the deposit. But about 100 feet above the limestone band an even and persistent bench probably marks the Upper Freeport coal bed.

There are indications of lower beds between the coal mine and the river. The first at a distance of 45 feet below the opening on D, at which point a small seam of coal 18 inches thick was at one time exposed, and at about 80 feet still lower the two small coal seams outcrop; the same beds which are exposed in the railroad cut at the mouth of Middle creek.

Sechler Mine.—On the top of the high plateau at the base of Negro Mountain, about one and a half miles east south-east of Castleman village, the Lower Freeport bed (D) is again mined on the property of Mr. Henry Sechler, the whole of the bed being exposed as follows:

Black slate.				
Coal	3′	0″	}	
Slate	0	2	} 3′	10′
Coal	0	8	}	
Slate		?		
Limestone.				

The coal does not show well, but considerable of it is nevertheless consumed in calcining limestone, in boiling maple sap (much maple sugar being made hereabouts), and in the winter time coal is almost universally used in the stoves.

The Seehler mine yields confessedly a poor quality of fuel, no better evidence of this fact being needed than that afforded by the ash heap at Mr. Sechler's sugar camp. The iron pyrite, which is abundant in the coal, reappears in the ash heap in the usual form of clinker.

The limestone underlying the coal has also been quarried on this property, but cannot now be seen; its thickness could not be ascertained, but on the adjoining farm of *Mr. J. Snyder* the same deposit shows 6 feet thick. At this latter place it is both ferriferous and argillaceous, the iron being especially prominent in the half calcined fragments.

The deposit is divided, by thin shaly partings, into three distinct and separate bands, the middle one of which is best adapted for fertilizing.

The coal bed, which appears here the same as at Sechler's mine, is separated from the limestone by an interval of $1\frac{1}{2}$ feet, made up of black slates and soft, impure fire clay.

At Sechler's mine, the hill rising to the east towards Negro Mountain, is benched as follows:

Section at Sechler's.

Top.		
Bench; bed E. (?)		
Interval	60′	0″
Bench; bed D′. (?)		
Interval	40′	0″
Coal Mine, bed D.		
Total	100′	0″

From this point the country rises very gently towards Negro Mountain, and these coals are pushed into the air before reaching the summit of the axis.

In the vicinity of *Weimer's grove*, about one mile south of Mr. Sechler's farm, mines are worked by Messrs. D. Weimer and S. Miller. These two are on the high land, and probably belong to the Freeport group. They were visited by Mr. Chas. A. Young, but their position in the measures was not definitely ascertained. Mr. Young reported the following sections:

Weimer Mine.—"D. Weimer's bank, 3½ miles south-west of Mineral Point. The bed is reported 3 feet thick, with a small slate band 1 foot above the floor. The coal is in high favor in the neighborhood.

Miller Mine.—"Miller's bank, situated one mile south of Weimer's grove. The bed shows:

Fire-clay shale.			
Coal, bony	0′ 6″		
Coal	1 6		
Slate	0 1		
Coal, bony	0 10	5′ 0″	
Slate	0 1		
Coal, hard	2 0		
Fire-clay,"			

Miller's mine is on a branch of Zook's run, the main fork of which stream heads on top of Negro Mountain, and winds down, through a deep ravine, emptying into the Castleman at Old Forge Bridge. In the sides of this ravine the Lower Productive coal beds outcrop.

Castleman Village.

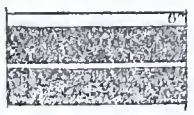
Returning again to the Castleman river, bed D is seen at a number of places on the north bank of the stream, between Castleman village and Pinkerton Point.

The hills on both sides of the river include higher seams than bed D, but the latter being by far the thickest seam and being also associated with an important, and, to the farmer, valuable band of limestone, is alone developed, the other beds of the Freeport group being almost totally unknown in the wooded hills between Castleman station and Pinkerton tunnel.

Further down the stream, in the Johnstown-Confluence sub-basin, the Upper Freeport coal is underlaid by limestone, and has on this account received some attention from the farmers.

Castleman Mine.—The lowest coal of the Castleman village section was once opened on the south bank of the river, nearly opposite the railroad station. The bed is small and in two benches, but is claimed to produce an excellent quality of coal. It measures as follows:

Fig. 77.



Slate	0′ 6″		
Coal	1 6		
Slate	0 2	3′ 2″	
Coal	1 6		
Fire clay.			

The bed is too small ever to be of much importance, and it is too close to water level to allow of being worked by drift, excepting in the direction of the rise.

This seam is thought to be the representative of *bed A*, a supposition confirmed by the appearance of an iron ore deposit which is seen 25 feet higher up on the hill. This ore has never been satisfactorily opened up, and the extent of the deposit is not known, but it gives every indication of being of value, and merits investigation. It is believed to be identical with the Hooversville ore.

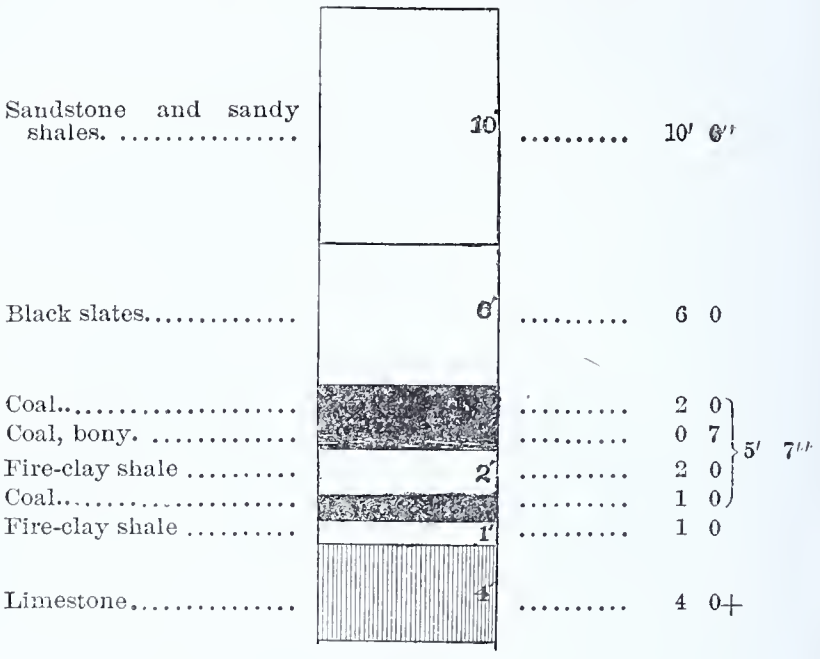
Bed B outcrops still farther up the slope. But only 2 feet of smut have been exposed, and this is perhaps the full extent of the bed, which, of course, would condemn it.

Still higher up, *bed D* and the *ferriferous limestone* were uncovered and their position in the scale thereby definitely ascertained. It was never worked at this place, but where opened by *Mr. Hochstedtler*, on the north bank of the stream, about one quarter of a mile south of the village, it shows as usual in two benches, separated by a wide parting of shale, full 1½ feet thick; the benches will aggregate, however, 5 feet of coal, of which that from the upper bench is soft, friable, and of columnar structure, while that under the shale parting is compact, hard and tough. The bed has never been worked and scarcely more than the outcrop of the seam has been exposed.

The accompanying limestone is found almost directly beneath the coal; only the upper layer of the deposit has been quarried and this is so highly argillaceous that only a small percentage of lime is obtained from it.

Zufall's Quarry.—Just beyond Hochstedtler's mine the Castleman river makes a sharp bend to the westward, maintaining this course for three-quarters of a mile; then it turns again as sharply southward, and at the second bend *bed D* is again exposed a few feet above the railroad, at the mouth of a small run coming in from the north. The exposure is on Mr. Zufall's land by whom both coal and limestone are worked, the open cut exhibiting the following complete section.

Fig. 78. Zufall's; Castleman River.


Sandstone and sandy shales. ..... 10' ..... 10' 6"
Black slates..... 6' 6 0
Coal..... ..... 2 0
Coal, bony. 0 7
Fire-clay shale ..... 2' 2 0
Coal..... ..... 1 0
Fire-clay shale ..... 1' 1 0
5' 7"
Limestone..... 4' ..... 4 0+

The full thickness of the limestone is not exposed, the deposit continuing for an additional two feet below the surface. It is much more free from impurities than at Hochstedtler's quarry, but yields, nevertheless, a grayish lime, streaked with red, and occasionally shows unslaked masses of a dark red color.

At Zufall's quarry the rocks are affected by a very decided local north-west dip, but the synclinal of the basin passes through Pinkerton Point, and the dip as seen at Zufall's cannot prevail very far to the west of the quarry.

Between Hochstedtler's and Zufall's the coal has a fall of about 60 feet.

A few hundred yards south of Zufall's, an extensive side cutting on the railroad has exposed bed D, together with its over and underlying rocks, the coal and limestone following along the bank for at least 100 feet.

This section varies very little from that obtained at Zufall's, but being very complete to the bottom of the limestone, it is introduced. It reads as follows:

Black slate.			
Coal	1′ 9″ to	2′ 0″	6′ 6″
Shale parting and bony coal		2 6	
Coal		2 0	
Slate and bony coal		1 0	
Limestone		2 0	
Shale		0 1	
Limestone		1 6	
Shale		0 1	
Limestone		1 0	
Fire clay		9 0	
Railroad level.			

The bed runs very evenly, forming an almost straight line in the cut.

Close to this exposure the coal was opened on the *J. Nicholson farm*, where both benches of the bed are mined. Specimens of the coal from this place were analysed a few years ago by Prof. P. Frazer, Jr., with the following results*:

	I. Upper Bench.	II. Lower Bench.
"Water	0.84	0.50
Volatile combustible matter	19.82	17.66
Fixed carbon (by loss)	71.32	51.43
Sulphur	1.53	3.11
Ash	6.49	27.30
	100.00	100.00

I. Ash gray, brown and gritty.
II. Ash brown, arenaceous and gritty."

From these analyses it will be seen that the lower bench is absolutely worthless, but that the upper bench yields an excellent coal.

Heinbach Mine.—Still further south (S. S.W.) the same bed is again mined on the Heinbach farm, high above the water, the barometer registering an interval of 150 feet between the mine and theriver. The bed here shows as follows:

Fig. 79.

Slate.			
Coal, bony	0′	3″	5′ 6″
Coal	2′	0″	
Bony coal and fire clay shale	2′	0″	
Coal	1′	3″	
Slate			?
Limestone			6′ 0″

*These analyses are here published for the first time, being taken from a private professional report on these lands by J. P. Lesley and F. Platt, 1871.

Of this coal Prof. Frazer also made two analyses of specimens from the same bench. The results obtained are as follows:

	I.	II.
"Water	(not determined)	0.780
Volatile combustible matter	22.74	20.540
Fixed carbon (by loss)	67.09	69.580
Sulphur	(not determined)	2.140
Ash	10.17	6.960
	100.000	100.000

I. Ash, light brown, arenaceous, gritty."

The limestone is claimed to rest upon a deposit of iron ore, the thickness of which is unknown. The ore is mentioned in Prof. Lesley's report, which is again drawn upon for the subjoined analysis of the Heinbach ore. The analysis reads (P. Frazer, Jr.):

"Water	0.11
Carbonic acid	29.89
Metallic iron	34.71
Calculated as protoxide	44.62
Requires of carbonic acid	27.26
Lime	6.29"

The Pinkerton Point section (Fig. 80, Page Plate XI) exhibits the rocks exposed between Heinbach's and Shoo Fly tunnel. The section is very nearly complete from the Piedmont sandstone to the Upper Freeport coal bed. The limestone band topping the section may belong, however, to the Middle Freeport deposit, but this seems improbable, and the deposit is referable rather to the Upper Freeport. The section is as follows, reading downwards:

Vertical Section at Pinkerton Point.

Limestone, ferruginous		2′ 0″
Interval		65 0
Sandstone		10 0
Slate		— –
Coal	Bed D	2 3
Fire-clay shale	Bed D	2 0
Coal	Bed D	1 3
Slate		?
Limestone, ferriferous		6 0
Iron ore		— –
Interval		69 0
Sandstone		8 0
Black slate		7 0
Coal		1 0
Fire clay, with ore		3 6

VERTICAL SECTIONS ON CASTLEMAN RIVER SOMERSET CO. PENNA

Fig. 80.
Pinkerton Point.

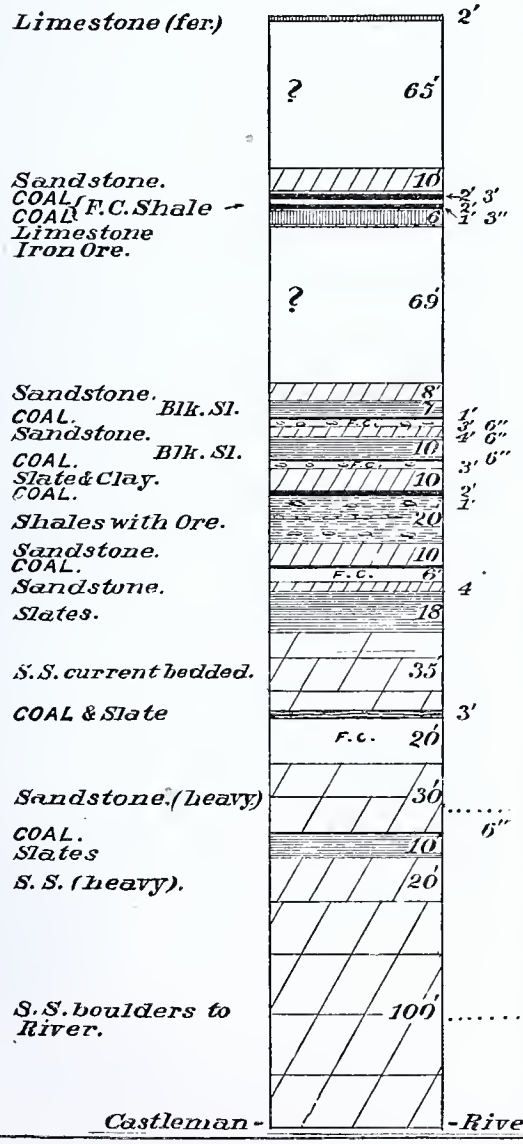
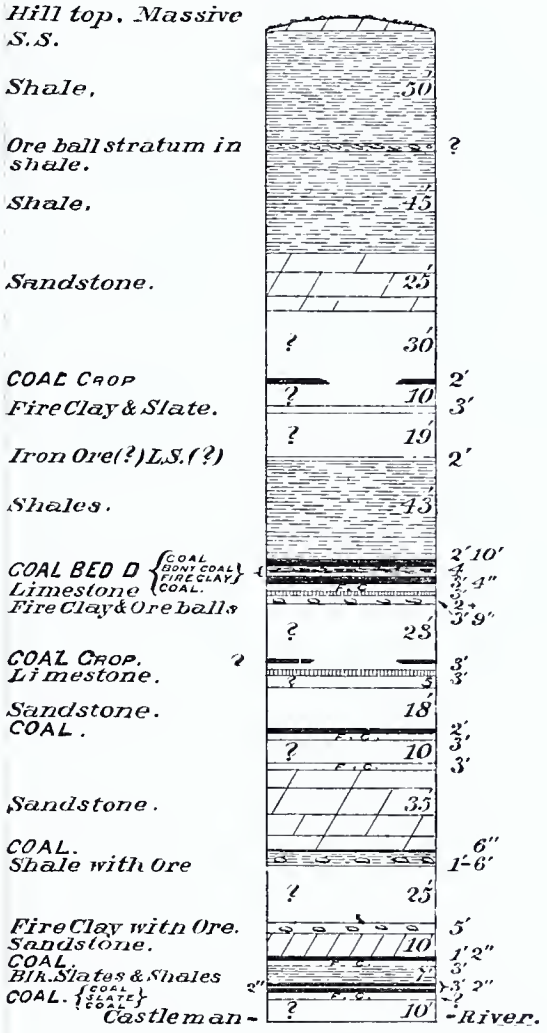


Fig. 76.
Castleman Village.


Hill top. Massive S.S.
Shale, 30'
Ore ball stratum in shale. ?
Shale. 45'
Sandstone. 25'
? 30'
COAL CROP 2'
? 10' Fire Clay & Slate. 3'
? 19'
Iron Ore (?) LS. (?) 2'
Shales. 43'
COAL BED D (COAL / BONY COAL / FIRE CLAY / COAL.) 2' 10'
Limestone 3' 4"
Fire Clay & Ore balls 3' 9"
? 28'
COAL CROP. ? 3'
Limestone. 3' 3'
Sandstone. 18'
COAL. 2'
? 10' 3'
Sandstone. 35'
COAL. 6"
Shale with Ore 1'-6'
? 25'
Fire Clay with Ore. 5'
Sandstone. 10' 1' 2"
COAL. F.C. 3'
Blk. Slates & Shales 2" 3' 2"
COAL. (COAL / SLATE / COAL) ?
Castleman - ? 10' - River.

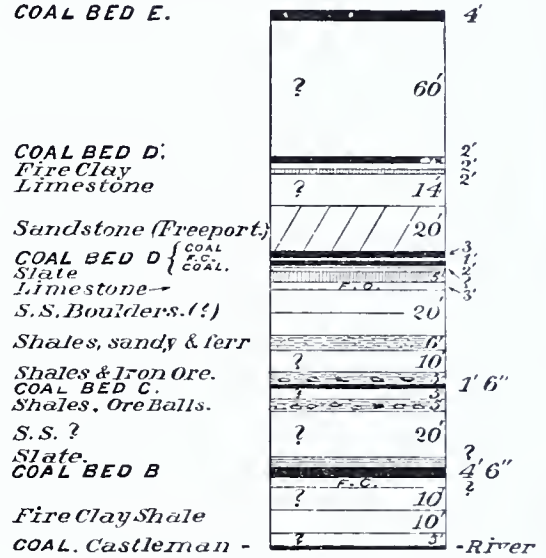
Piedmont Sandstone.

MOUNT SAVAGE COAL BED ?.

Pottsville Conglomerate (XII.)

SECOND GEOLOGICAL SURVEY OF PA.
REPORT OF PROGRESS
HHH
BY
F. and W.C. PLATT.

Fig. 75.
Mineral Point.


COAL BED E. 4'
? 60'
COAL BED D. 2'
Fire Clay 2'
Limestone ? 14'
Sandstone (Freeport) 20'
COAL BED D (COAL / F.C. / COAL.) 3' 1' 2'
Slate 1'
Limestone — F.C. 3'
S.S. Boulders. (?) 20'
Shales, sandy & ferr 6'
? 10'
Shales & Iron Ore. 3'
COAL BED C. 1' 6"
Shales. Ore Balls. 3'
S.S. ? ? 20'
Slate. ?
COAL BED B 4' 6"
F.C. ? 10'
Fire Clay Shale 10'
COAL. Castleman - ? 3' - River
FEET 650 600 500 400 300 200 100

O.B. HARDEN DEL.

Sandstone	4′	6″
Black slates	10	0
Coal	0	6
Fire clay with ore balls	3	0
Slate and clay	10	0
Coal	2	0
Fire clay	1	0
Level of Railroad.		
Shales with ore balls, and apparently one continuous small ore band	20	0
Sandstone, brownish	10	0
Coal	1	0
Fire clay	6	0
Sandstone	4	0
Slates, dark colored	18	0
Sandstone, current bedded	35	0
Coal and slate	3	0
Fire clay, impure	20	0
Sandstone, heavy	30	0
Coal	0	6
Shales, brown	10	0
Sandstone, heavy	20	0
Sandstone boulders to river	100	0
Fort Hill station.		
Total	485	6

This section was measured with great care, and is believed to be entirely accurate, notwithstanding that it cannot be joined on quite satisfactorily to the Castleman village section, which was also constructed with equal care.

The hills at Pinkerton Point are a part of the high land which marks the rim of the Viaduct axis. The close proximity of the synclinal and anticlinal axes, where both cross the Castleman, is observable along the railroad at Pinkerton Point, as is also the disturbance caused by the Viaduct axis. The exposures are very complete betwen Pinkerton tunnel and Shoo Fly tunnel, one mile further west. These railroad cuts display handsomely the shallow roll in the rocks which prevails from tunnel to tunnel. The movement is easily traced by following a small but persistent coal bed, which, after descending steadily south-west from far above Pinkerton tunnel, comes down nearly to a level with the grade of the railroad, about midway between the tunnels, and then as steadily rises to overshoot the railroad cut at Shoo Fly.

Identifying the coal and limestone at Heinbach's as belonging to bed D, the small coal just above the railroad at Pinker-

ton tunnel is in place for bed B, and bed C would then come in regularly 30 feet higher. Below this latter bed occurs a plate of carbonate ore, which was opened up a few years ago, and as seen by Mr. Franklin Platt, while on a professional visit to this section, measured 12 inches in thickness. Specimens of the ore were obtained at that time, and an analysis by Prof. Frazer showed the following constituents:

"Water	0.39
Carbonic acid	17.88
Metallic iron	29.52
Calculated as protoxide	37.95
Requires of carbonic acid	23.19
Lime	1.68 (?)"

At the eastern entrance of Pinkerton tunnel the railroad is 30 feet, by barometer, above the Castleman, and as this is only about one-half the interval between beds A and B, *bed A* is therefore beneath the river at Pinkerton, but emerges to the *south-east* a short distance below in the bend. It is level with the railroad at Shoo Fly tunnel. It there appears overlaid almost directly by heavy massive sandstone, 30 feet thick, while beneath the coal is a large mass of impure fire-clay.

Shoo Fly Tunnel.

An irregularity both interesting and instructive occurs at this place. Fig. 82, Page Plate XII, shows the nature of the irregularity, the details of which are given below. Notwithstanding the proximity of the occurrence to the Viaduct anticlinal, it seems unlikely that the two are in any way intimately associated or owe their origin to one cause.

The Shoo Fly exposure shows an unevenness which existed in the old floor on which the coal was laid down, a fact substantiated by the sudden thickening of the coal and its overlying shale. The irregularity originally existed in the old swamps, and was simply a depression, with rather steep sides, which was ultimately filled up with clay; and the sand subsequently deposited on top of all fell upon a level bottom composed of mud.

Fig. 563, Page Plate XII, exhibits a form of irregularity in coal beds, both frequent and troublesome in the bituminous regions. It is reproduced from Rogers' Final Report of 1858. This was also observed in the Castleman valley, and is referred

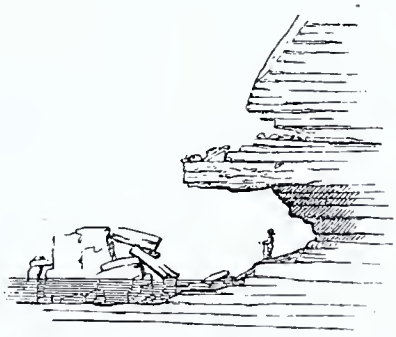


FIG. 562.—Castleman's River and Conglomerate Cliffs (in partial section).

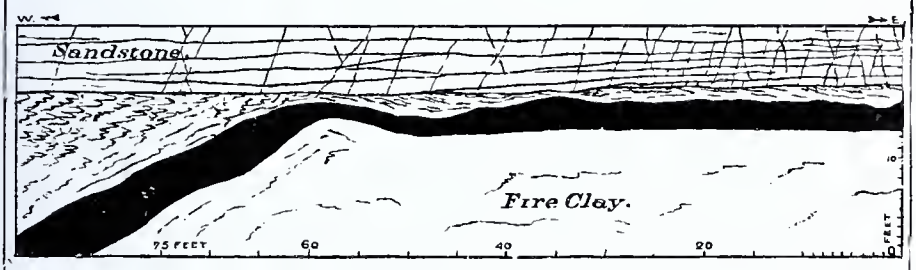


FIG. 81.—Coal bed A at Shoo fly Tunnel, P. and C. R. R.

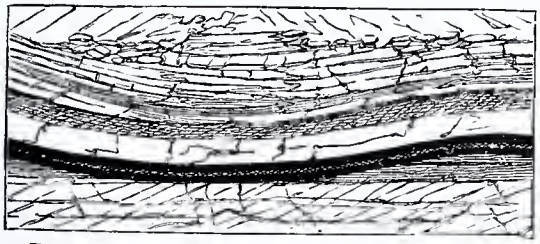


FIG. 563.—Palæozoic Denudation, exhibited on Castleman's River.

to by Prof. Rogers as "an instance of ancient denudation, producing hollows in the surface of a bed of black slate upon and in which coal was afterwards deposited.*

Mr. Andrew Roy, State Mine Inspector of Ohio, has also shown with what frequency such depressions prevailed in the old surface on which coal No. 1 of the Ohio series was deposited, and has further graphically illustrated the subject in his Third Annual Report by two wood cuts.†

Fig. 562, Page Plate XII, also from Rogers' Final Report, is an instance of recent denudation. It has no particular application to the irregularity at Shoo Fly, but being an interesting occurrence is reproduced. The cliffs were destroyed by the grading of the Connellsville railroad. Prof. Rogers, in alluding to the exposure, says that "along the right bank, [of the Castleman river,] below the mouth of Scrubglade run, the sandstone and conglomerate rocks are so arranged, in more or less durable alternations, as to present remarkable overhanging cliffs, worn by the yearly freshets which rush down the river bed in early spring. The annexed sketch represents such a cliff, one layer of which overhangs the river 12 feet."‡

The trouble at Shoo Fly occurs in the western approach to the tunnel, this portion only being represented in Fig. 82. Briefly described, the irregularity is as follows:

At the extreme end of the eastern approach to Shoo Fly the coal makes its appearace just above the railroad. At the eastern mouth of the tunnel the entire bed is regularly developed and is exposed 3 feet thick, the coal having risen 5 feet vertically in a horizontal distance of about 50 feet. A few feet of fire-clay intervene between the bed and the massive sandstone overlying, the coal likewise resting upon fire-clay. The rocks are rising rapidly to the west, and at the opposite end of the tunnel, 100 feet away, the coal occupies a position from 12 to 15 feet above the railroad, this interval being made up by a stratum of coarse, impure fire-clay shale.

The westerly rise is now at an end, and the rocks including the coal bed become flat, remaining in this position for about

*Geol. Penn., 1858, page 659. Original sketch by J. P. Lesley in 1849.

†Pages 137 and 139, Third Annual Report, State Mine Inspector of Ohio.

‡Geol. Penn., 1858, page 658. Sketch by J. P. L. in 1849.

40 feet, the shale over the coal having meanwhile thinned out and disappeared. Sandstone then rests directly upon the coal, which suddenly becomes reduced to one-half its normal thickness, and after describing a short synclinal roll, at once plunges westward at an angle of 22°, which soon carries it beneath the railroad. Associated with this plunge is an equally sudden expansion of the coal, and a much more noticeable swelling in the shale resting on top of it. The sandstone does not participate in the plunge to the westward, but remains horizontal throughout the western end of the cut.

The coal sinks beneath the railroad before the end of the cut is reached, but must soon reappear in the flat beyond. Unfortunately this is not shown, nothing being visible along the railroad for a considerable distance beyond the western end of Shoo Fly tunnel. But the coal bed certainly overshoots the railroad cut at Fort Hill, and then descends into the Johnstown-Confluence sub-basin. The same coal is believed to have been once mined a few feet below the railroad, on Mr. Augustine's land, near the Brook tunnel.

PART III.

THIRD SUB-DIVISION

OF THE

FIRST BITUMINOUS COAL BASIN.

IN

SOMERSET COUNTY.

CHAPTER XII.

General Description of the Johnstown-Confluence Sub-Basin, with that part of Laurel Hill included in Somerset County.

The Johnstown-Confluence sub-basin of Somerset county is the synclinal trough lying between the Viaduct Anticlinal Sub-axis on the east and the Laurel Hill or First Anticlinal Grand axis, on the west. These same boundary lines mark the limits of the basin all through Cambria and Clearfield counties to the north-east.

The Viaduct sub-axis has been elsewhere described in detail; and of Laurel Hill little more need be said than that it is a broad, regularly shaped, massive mountain of anticlinal structure, from the top of which the Productive coal measures have been swept away by eroding waters until not a trace of them remains. The Great Pottsville Conglomerate is therefore uncovered all along the top of the mountain, from the Conemaugh to the Youghiogheny, but over certain areas even this formation has disappeared, giving place to the Mauch Chunk Red Shale of XI, which then reddens the soil along the centre of the anticlinal.

From the Cambria border to the Youghiogheny gap, Laurel Hill runs in an unbroken straight line along the western edge of Somerset county. Its crest is a wide flat, regular and uniform, rising and falling somewhat, but maintaining an average elevation of about 2,500 feet above tide level. Its eastern slope is gashed by numerous ravines, down which in spring time flow small mountain streams which fill the creeks at the centre of the trough. A thin covering of Productive coal measures overspreads the lower portions of the slope, but does not extend to the summit of the mountain, being crowded into the air by the outcrop of the Conglomerate of XII.

Where Laurel Hill crosses the Youghiogheny river it is cut to its base in a gap 5 miles in length, with precipitous sides, the tops of which overlook the waters by 1,000 feet. The gap is a wilderness from end to end, exposing in its steep walls arches of Formations X, XI and XII. The few developments that have been made in this gap are described in detail on a succeeding page. After crossing the Youghiogheny Laurel Hill leaves Somerset county and strikes into Fayette, running through the south-eastern corner of the latter county, the western boundary line of Somerset county being taken up at Laurel Hill gap by the Youghiogheny river and continued thence to the Mason and Dixon line.

The Johnstown-Confluence sub-basin maintains an average *width* of seven miles from the Cambria border to the Castleman river; thence to the Maryland line it steadily widens as the Somerset sub-basin grows narrower by the deflection of the Viaduct anticlinal from its usual course, an occurrence already fully treated in Chapter VI.

The basin varies very greatly *in depth* along its synclinal or central line, from which line its rocks rise gently in both directions towards the anticlinals. This central line apparently rises and falls with the Viaduct axis, a fact exemplified by the drainage of the basin; but the waves are of such gradual sweep that the effect is only visible over extensive areas.

Coming into the basin from Cambria county we find but little more than the Lower Productive coal rocks represented above water level, at the old Jackson tavern, near the centre of the trough. But in ascending *Ben's creek* for a few miles

these coal rocks slowly disappear beneath water level, and at Forwardstown are lost altogether, the Lower Barren Measure rocks which overlie the Lower Productive coals being there piled up to the extent of 400 feet.

Elk Lick Coal and Limestone.

This is a sufficient accumulation of rocks to allow the Elk Lick limestone to come into the hilltops, and it is probably this deposit which is worked by Mr. Berkey a short distance south of Forwardstown. That this is the correct identification is further substantiated by the limestone bands which are found lower down in the measures. Thus the Harshberger limestone would correspond with No. III, of the Berlin section, (see page 35,) and the smaller band found at Forwardstown, 40 feet above water level, would be in place for the deposit accompanying the *Philson coal bed* at Berlin.

Some distance above the Elk Lick limestone, the Elk Lick coal comes in, and covers a very small area, only from Berkey's to Harshberger's; the same bed appears again in the vicinity of Confluence, (the Turkey Foot,) but much reduced in thickness.

From Berkey s place the .country falls off somewhat, and the basin grows shallower in proportion; although Barren Measure rocks continue to prevail along the synclinal across the Jennerville pike and into Somerset township, the Lower Productive coal rocks, however, being exposed along the streams flowing close to the anticlinals.

Crossing the central water shed of the county, one begins to descend Laurel Hill creek to Confluence; throughout the greater portion of this deep valley the Lower Productive coal measures are exposed, but gradually get below the creek, until at Confluence the Elk Lick limestone crowns the tops of Barren Measure hills, 250 feet in height. These same measures then continue southward along the synclinal axis of the basin nearly as far as the Maryland line.

From this description it is evident that the Lower Productive coal measures cover a large portion of the basin; at times being above water level and accessible from the outcrop, and on

the other hand, often buried deep beneath a mass of Barren Measures.

The Lower Productive coal group consists here of the same beds which compose it throughout the entire First Basin. Very few openings have been made on the lower coals in the Johnstown-Confluence sub-division of this great trough; but such beds as have been exposed rarely present a flattering prospect, being usually thin and somewhat slaty; occasionally, however, the show is promising. Actual development can alone establish the practical worth of the beds.

The Lower Productive group chiefly outcrops along the sides of the basin, and in the slopes skirting the larger streams. The centre of the trough is especially interesting, however, as affording a good opportunity for the study of the Barren Measure rocks, the same amount of these rocks being here repesented as in the Berlin region; and the sections in the Johnstown-Confluence sub-basin are sufficiently complete to show that the coals and limestones included in these measures run with great persistency and are identifiable over broad areas. The coals vary widely in thickness, and economically considered are of little importance, a striking illustration of this fact being found in the Rose (Philson) bed, once mined at Ursina. The limestones on the other hand are far more regular, and are hence safer and more trustworthy guides for the purpose of identification.

In the main, however, the seams of the Barren Measures are scarcely more than thin streaks of coal between the rocks. Occasionally, but very rarely, the conditions were favorable at the time of the deposition of these measures to an accumulation of vegetable matter, and in such places we now find what must be regarded as an abnormal development of the bed.

Iron Ores.—Little attention has hitherto been paid to the iron ores of the basin. A single attempt was made many years ago to make iron from native ores in a small furnace at Forwardstown, but the supply of ore failing the enterprise was abandoned. The hills thereabouts were at that time thoroughly picked over, but no reliable *band of ore* could be discovered. This however applies only to Forwardstown, and precisely the same rocks may elsewhere include a workable ore band which might repay development Nothing in the coal meas

ures is more variable than the iron ore deposits, a fact well exemplified by the extended developments of the Cambria Iron Company at Johnstown, as well as at numerous other localities in the coal regions. The discovery of workable iron ore deposits in the coal measures, (and by a workable deposit is meant a regular and persistent layer of *good* ore of workable thickness,) has generally been the result of chance, and experience has demonstrated that such layers are frequently confined to certain limited districts. Thus, the Johnstown iron ore band as it exists at Johnstown is not known in Somerset county, although the rocks which prevail at Johnstown cover a large portion of the county. Its outcrop is frequently noticeable in the Johnstown-Confluence sub-basin, but it exists only as ferruginous shales containing scattered nodules of ore. Attention is frequently called to such occurrences throughout the following pages.

Some of the most productive farming land in the county is found on the top of the plateau, along the centre of the basin. Limestone is abundantly scattered not only through the Lower Productive rocks, but also through the Barren Measures, as here developed, and excellent fertilizing material can therefore be obtained close at hand.

The three sub-basins of Somerset county offer unusually excellent opportunities to study the effect of geological structure upon the surface of the country.

Where the Upper Productive Measures are the country rock, as in the Salisbury basin, the massive limestones overlying the Pittsburg Coal Bed have offered a potent obstacle to erosion, and thus afford a level plateau, on top of which the easily disintegrated shales make a deep soil. As limestone is abundant, this soil is well enriched and thoroughly cultivated.

The Barren Measures weather down into gently sloping hillsides, also covered deeply with soil from the wearing down of their soft slates and shales.

Where the limestones of the Barren Measures are large and good for burning, the soil is well enriched and the farms are very productive; but where the limestones are wanting, or if found, are small and poor, the soil is somewhat clayey, and yields but a moderate return to the farmer.

The Lower Productive Measures, with their massive sandstones, make steep hillsides, usually rugged and frequently entirely covered by large boulders of the Mahoning, Freeport or Piedmont Sandstones, or of the Pottsville Conglomerate. These changes occur within such short distances that they naturally attract the attention not only of the geologist, but also of the observant traveller

CHAPTER XIII.

Detailed Description of Johnstown-Confluence Sub-Basin, in Somerset County, as far south as the Bedford Pike.

To the south of Stony creek at the Red Bridge the country rises sharply for several hundred feet above the stream, and holds all the rocks of the Lower Productive coal measures.

On this hillside, and directly south of the Red Bridge, *Mr. Kring* has opened up the outcrop of *bed D* 145 feet above the water. The bed here yields about 5 feet of coal, and is underlaid at a short interval by a stratum of impure ferruginous limestone, nearly 8 feet thick.

Just above the water at the bridge a 3-foot bed of coal outcrops on the opposite side of the stream. This seam has already been identified on a former page as *bed A*.

Bed B has not yet been looked for on Kring's Hill, but a distinct terrace about 80 feet below Kring's mine most probably marks the outcrop of this seam. The Middle and Upper Freeport coals likewise remain unexplored in the vicinity of the bridge, but have been discovered and exposed on two adjoining farms about one mile south-south-east of Kring's mine.

These exposures are found on the eastern bank of a small run which empties into Stony creek a short distance above the mouth of Ben's creek. Bed D being by far the largest bed of the Freeport group hereabouts is almost the only coal mined throughout this neighborhood; but the overlying seams have nevertheless been picked into or exposed accidentally, and the thickness of the beds thereby obtained.

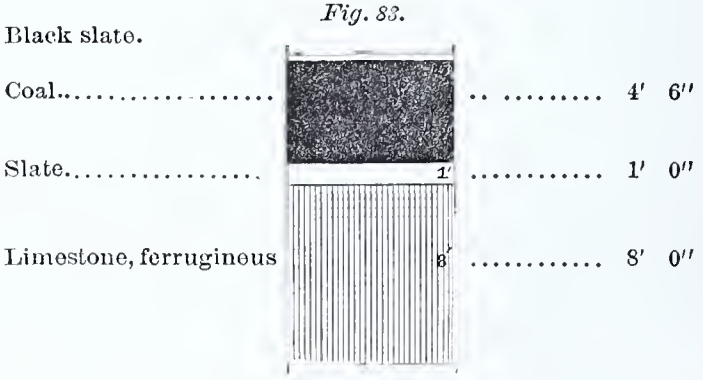
The following vertical section, Fig. 82 (Page Plate XIII,) was made on Yoder's farm, about one mile south-east of the Red Bridge. It serves very well to show roughly the distances between the coals of the Freeport group at this point:

Vertical Section at Yoder Farm.

Hill top.		
Interval, no exposures	125′	0″
Bench?		
Interval, sandstone in masses on surface	75	0
Coal, bed E	3	0+
Interval	65	0
Coal (parted in the centre by a thin band of slate) bed D′	3	0
Limestone	3	0
Interval	from 35 0 to 40	0
Coal in Yoder's mine, bed D.		
Limestone, ferruginous.		
Small run.		
Total	314	0

Yoder Mine.—Yoder's mine is about 10 feet above water level; it is run in on a south-east (S. 50° E.) course and rises sharply with the coal. At the mouth of the mine rusty black slates overlie the coal for 12 feet; these are in turn overlaid by thin bedded sandstone. At the face of the main gangway this section of the bed was obtained:

Fig. 83.



The coal is hard and tough; it is slightly pyritous, but does not carry a damaging amount of this impurity. It shows horizontal crystallization.

The same bed is also exposed on *Mishler's farm*, one-third of mile below Yoder. An opening was recently made at this place, and the coal was firm and good from the start. The gangway is not over 100 feet in length, but the bed shows a steady thinning from its abnormal thickness at the outcrop. Four and a-half feet of coal were seen at the face of the mine, and this may fairly be regarded as the average thickness of this bed in this vicinity. The mine is 35 feet above water level.

Both of the upper coals have been found by Mishler on his property, the Middle Freeport bed being underlaid by limestone.

The hill between the plank road and Stony creek is unbroken, and the expanse of coal covered by it is therefore comparatively great.

A short distance to the north of Mishler's house is the famous "Hog's Back" exposure, already described in the Report of Progress in Cambria county.*

On the plank road, at the school-house, one-third of a mile south-west of Mishler's buildings, bed D shows on *Kaufmann's farm.* The coal has never been mined at this place to any extent, but sufficient fuel is taken out for the use of a few families in the immediate neighborhood.

Livergood Mine.—A seam of coal, most probably belonging to the Freeport group, is worked on Livergood's land, three-fourths of a mile south-east of old Ben's Creek Furnace. It yields over three feet of coal as follows:

Slate.
Coal ..... 3' 2"
Fire-clay.

The coal shows reasonably well, but is heavily loaded at times with iron pyrites.

The hill to the west of the mine rises abruptly, and no terraces show on its flank.

Search has been made at different times for the *iron ore* deposit once worked by Dr. Schœnberger near the head of Mill creek, but with unsuccessful results. If this ore should extend south of Ben's creek, on which however it has not yet been found, the hillside is sufficiently high to include it.

Ben's Creek Furnace.

Near the mouth of Ben's creek stood Ben's Creek Furnace, which was operated for a number of years very successfully by the late Dr. Schœnberger. A considerable amount of iron has been made at this place, the furnace having been run exclusively on coal measure ores. The supply of material was obtained from the iron ore deposit which is found above water level near the head of Mill creek, an affluent of Ben's creek.

*HH—pp. 125 and 126.

This ore deposit, elsewhere identified as corresponding in position to the famous Johnstown iron ore band, was traced for some distance along the valley of Mill creek, but it has never been found in the vicinity of Ben's Creek Furnace. The hills overlooking the old furnace contain as much as 200 feet of Barren Measure rocks, and are therefore abundantly high to include the Johnstown ore band, if it should extend to this point as a workable deposit; of the probability of this reasonable doubt may be entertained.

In ascending Ben's creek the country to the north and south continues as high land.

No developments of any kind are visible in the sides of the valley until the forks of the creek are reached in the neighborhood of the old Jackson tavern.

Directly at the forks of the stream borings were at one time made for salt, and it is claimed that nine feet of coal (and slate ?) were passed through some distance below the surface. The precise depth at which the coal was struck is now forgotten.

Water containing both sulphur and iron in solution flows copiously from the well, which goes by the name of the "Sulphur Spring."

Barnhardt Mine.—At this place a second bed of coal was discovered 15 feet above the creek level. The same bed is worked on Barnhardt's property one-half of a mile further south, where it shows in this way:

Roof, black slate	8′ 0″
Coal	3 0
Slate	2 6
Carbonate iron ore	?

The coal has a bright rich lustre, and is soft and friable.

It is difficult to assign to this coal its proper place in the measures. A satisfactory vertical section could not be obtained, but the outcrop was thought to belong to *bed D.* A high hill rises westward from the mine. Several well marked coal benches terrace the slope, and additional beds of coal are reported to have been found, but the thickness of the seams could not be ascertained. More thorough developments at this place may possibly serve to identify Barnhardt's coal with a

bed lower in the series than D; but in the light of present facts, this does not seem probable.

The measures are here rising sharply to the north-west towards the First Grand Axis (Laurel Hill).

On the Ligonier Pike, a few hundred yards west of the old *Jackson tavern*, two coal beds, 35 feet apart, outcrop in the side of the road. Of the thickness of the upper bed nothing whatever is known, but the lower bed was once drifted in upon from the outcrop, and was found to yield 3½ feet of coal. This drift however subsequently fell shut and was abandoned.

The lower of these beds is probably the same as the coal worked by Barnhardt, the difference of level being accounted for by the rapid rise of the measures to the north-west.

Dalton's Run.—At the opening on Dalton's run, one-third of a mile north-west of the outcrops on the Ligonier Pike, the lower bed is underlaid by limestone, 5 feet thick, in this way:

Black slate.	
Coal	3′ 6″
Slate	1 0
Limestone	5 0

A comparison of this section with that obtained at Barnhardt's mine will show that if it be the same bed in both places, as is presumed, then the upper portion of the limestone has, in the interval, changed to a carbonate iron ore. It should be stated, however, that the identification here made is not absolute and complete. A considerable distance intervenes between the outcrops, and in the absence of accurate levels nothing more positive can be stated than is given above.

The outcrop on Dalton's run is 40 feet above the water, and occurs on a steep and uncultivated hillside. The outcrop, opened up merely to prove the thickness of the bed, has never been followed beyond the soft worthless coal.

Pieces of limonite show on the surface of this hill slope 200 feet above the coal exposure. These fragments are said to mark the outcrop of a band of carbonate iron ore claimed to be from 18 to 20 inches thick.

Several trial pits were apparently sunk on this ore, but were subsequently filled up.

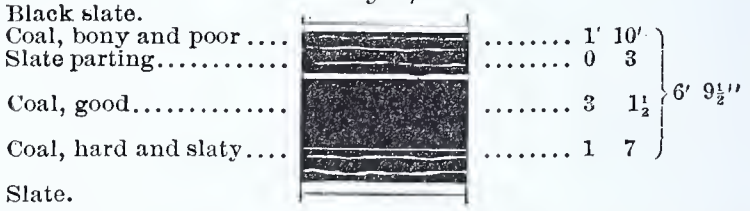
Ascending the South Fork of Ben's creek a short distance beyond Barnhardt's mine a small bed of coal, estimated to overlie the Barnhardt mine (D ?) by as much as 40 feet, has been opened up.

This occurs near *Mr. Blough's* house, and if the former identification be correct, is the outcrop of *bed D'*. Near this outcrop a thin band of limestone about $2\frac{1}{2}$ feet thick was recently found; this is believed to underlie by a few feet the coal at the house.

Thomas Mine.—On the Thomas property, some three miles south-south-west of the openings just described, a still higher seam of coal has been exposed at several points above water level.

This is the outcrop of the Upper Freeport bed, which here shows as follows:

Fig. 84.



At this mine the rocks are clearly dipping north-west but as the central line of the basin or synclinal axis passes only a short distance west of Thomas' mills the incline is gentle.

In ascending the stream the Upper Freeport coal gets below the creek bed, and is not seen at Forwardstown. The coal was estimated to underlie the level of the stream at the latter place by as much as 40 feet, and probably more.

The hills at Thomas' rise high above the water, showing a succession of low and uneven benches, nearly all of which have been investigated, but with unsatisfactory results, being made up of the rocks of the "Barren Measures."

An outcrop of carbonate iron ore was observed along the Pike about 60 feet above the Upper Freeport coal. This ore has never been thoroughly opened up, and whether the deposit is of value or not, is not known.

Forwardstown.

At the village of Forwardstown, $1\frac{1}{2}$ miles west-south-west of the Thomas mine, no workable coal bed has been found

above water level, nor does such a discovery seem likely to be made.

High land here skirts Ben's creek, but it is manifest, after what has already been said, that these rocks belong to the "Barren Measures."

Although a tolerably thorough investigation of the hill slopes around Forwardstown has failed to reveal a coal bed of workable dimensions, it has nevertheless served to disclose a surprising amount of limestone.

The relative position of these limestone bands will be found in the detailed section described further on.

A small charcoal furnace was established at Forwardstown many years ago in the belief that iron ore abounded close by, but the enterprise was subsequently abandoned for lack of sufficient material in the neighborhood on which the furnace could be run with profit.

Passing south-west from Forwardstown the high land is ascended which divides the waters of the South Fork of Ben's creek from those of Roaring run.

The Elk Lick Coal and Limestone.

A valuable bed of coal has been found on the summit of this plateau.

This coal is confined to an exceedingly limited area, its outcrop ranging for a short distance along the centre of the basin. It was estimated to overlie the upper member of the Freeport group (E) by as much as 400 feet, and the bed certainly overshoots the hill tops at Forwardstown, only missing them however by a few feet. Nor can it be found in the hills to the east of the headwaters of Ben's creek. Its outcrop extends as far south as *Jeremiah Berkey's* farm, where it has been opened up and is now mined near Mr. Berkey's house. The same bed is also exposed on the adjoining farm of *Mr. Glessner*, the two mines being only a few hundred yards apart; and it is again worked by *Mr. Harshberger*, two-thirds of a mile north-north-west of these latter openings. This, however, is its northernmost limit, for the coal does not seem to pass Mr. Harshberger's house.

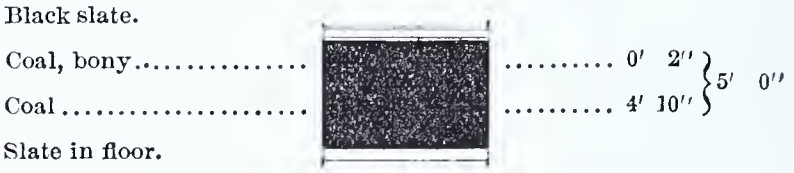
The bench of the bed caps the hill at each place, but an excellent roof of tough clay slate has protected the coal from percolating waters and kept it firm and dry.

The coal is not of a very high quality, being considerably intermixed with earthy matter, besides carrying a liberal amount of iron pyrites. It is admirably adapted however for the purposes for which it was applied, namely, for calcining limestone and for supplying the surrounding country with fuel. Inasmuch as the bed spreads over a very limited area the greater part of the coal will doubtless be worked out in a comparatively short time.

The coal shows in one solid breast, without persistent partings of slate. Along the centre of the bed ranges a thin band of soft, friable coal, about 1 foot thick; this coal is bright, shining, and has a columnar structure; it is used chiefly by the blacksmiths. The balance of the bed yields a totally different coal from that just described; it is smooth, hard, firm and of horizontal bedding; it mines out in blocks, and though possessing a rich appearance, shows a dull lustre at the fracture. These features were found to be regular and persistent.

Berkey Mine.—The following section of the bed, made in the Berkey mine, shows the average thickness of the seam:

Fig. 85.



An analysis of the coal from a specimen forwarded to the Laboratory by Mr. Berkey gave the following results (A. S. M'Creath):

"Water at 225°.....	.890
Volatile matter.....	20.525
Fixed carbon.....	65.903
Sulphur.....	1.142
Ash.....	11.540
	100.000

Coke per cent, 78.585; color of ash, reddish gray.

The coal has a resinous lustre, is generally compact and somewhat slaty, and carries a few thin partings of iron pyrites."

This coal bed is at once lost in going south-west from Berkey's mine, the country falling away somewhat in that direction towards Roaring run. The Barren Measure rocks continue, covering the surface with soft slates and shales, and spread southwestward past Jennerville, and across the Stoystown pike.

About 40 feet below this coal bed a smaller seam is found which has been exposed on Mr. Berkey's farm in quarrying the limestone by which the coal is underlaid.

The bed averages nearly 3 feet in thickness, being parted near the centre by a thick band of clay. The coal, however, is poor, as the following analysis shows (D. M'Creath):

"Water at 225°	1.100
Volatile matter	20.505
Fixed carbon	63.470
Sulphur	3.785
Ash	11.130
	100.000

Coke per cent, 78.385; color of ash, red.

The coal is dull, dirty, tender, coated with iron oxide and seamed with iron pyrites."

The extensive "strippings" on Mr. Berkey's farm furnished accurate measurements of the bed together with the rocks directly over and underlying. These measurements will be found incorporated in the detailed section of this region given below, and need not here be repeated.

Allusion was made on a preceding page to the abundance of excellent limestone existing throughout this region. Analyses were made of specimens from the two principal deposits, the first of which in descending order (Elk Lick Limestone) occurs, as just stated, about 40 feet below Mr. Berkey's mine. It yields upwards of 8 feet of limestone, which calcines easily and produced a strong white lime sufficiently pure for plastering purposes. It is quarried in considerable quantities by Mr. Berkey, from whose property a specimen was obtained for analysis. This analysis, by Mr. A. S. M'Creath, resulted as follows:

"Carbonate of lime	89.522
Carbonate of magnesia	5.327
Carbonate of iron	1.812
Alumina	.224
Sulphur	.245
Phosphorus	.016
Insoluble residue	2.500"

The limestone is tough, compact, of a bluish cast, and breaks with a slightly conchoidal fracture."

The second limestone of importance is 100 (?) feet lower down. It is quarried by Mr. Harshberger a few yards west of the Pike, at a point about one mile above (south of) Forwardstown, not more than ten feet above water level.

A specimen of this limestone was secured for analysis which resulted as follows (A. S. M'Creath):

"Carbonate of lime	80.588
Carbonate of magnesia	8.445
Carbonate of iron	3.314
Carbonate of manganese	1.400
Bisulphide of iron	.371
Alumina	.455
Phosphorus	.026
Insoluble residue	4.803
	99.402

Compact, minutely crystalline; spotted with iron pyrites, color, bluish-black."

Two smaller seams of limestone are found still lower in the series, the lowest occurring in connection with a thin and unimportant coal bed. The lowest limestone occurs about 40 feet above the creek level at Forwardstown.

Several small seams of coal and iron ore are claimed to have been found in the 400 feet of interval between the topmost coal of this region and the Upper Freeport bed, but the openings which have been made at various times on these strata have now fallen entirely shut, and as the statements respecting them conflict somewhat no reported measurements are here reproduced. Practical experience has, however, clearly shown that neither coal nor iron ore abound in this vicinity above water level.

The relative positions of these different beds, as reported, are indicated in the section given below.

Absolute accuracy is not claimed for this section. The greater part of the rocks which make up the hillsides in the vicinity of Forwardstown are wholly concealed from view, so that the section shows only imperfectly the actual thicknesses of the different strata. Moreover, many of the intervals were estimated; but it is believed that the section is reasonably accurate. It reads as follows, Fig. 86, (Page Plate XIII):

SECOND GEOLOGICAL SURVEY OF PA.

1876

Fig. 86.

Forwardstown.

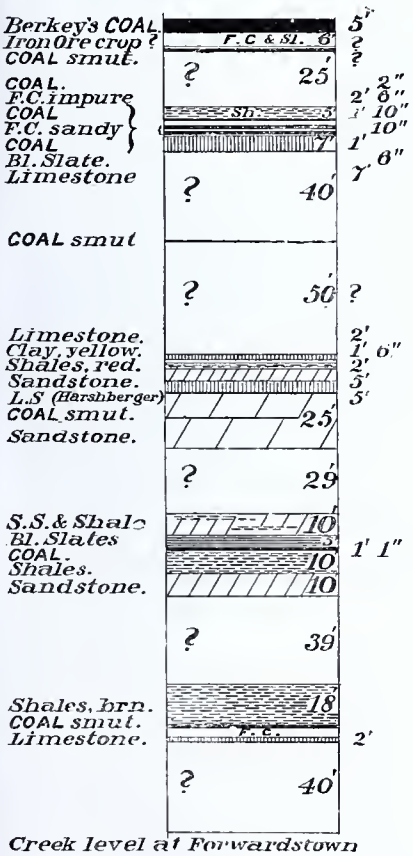
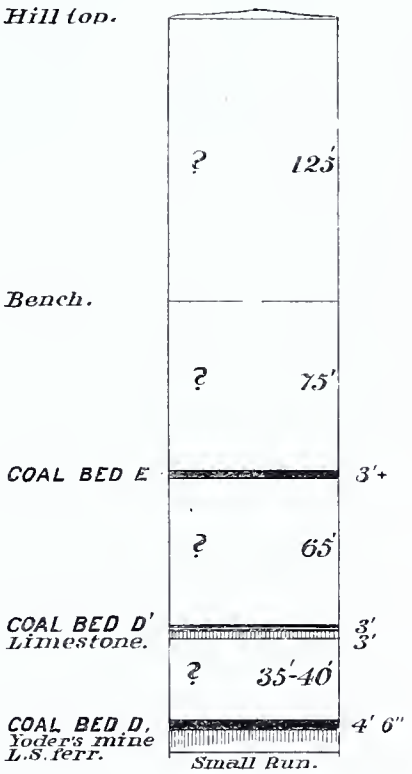


Fig. 82.

J. T. Yoder.



O. B. HARDEN. DEL.

Vertical Section at Forwardstown.

Berkey's coal (Elk Lick)		5′	0″
Fire clay and slate		6	0
Iron ore outcrop?			
Coal smut?			
Interval		25	0
Sandy shales		5	0
Coal smut		0	2
Fire-clay, impure		2	6
Coal	Elk Lick.	0	10
Fire-clay, sandy	Elk Lick.	0	10
Coal	Elk Lick.	1	0
Black slate		0	6
Limestone (Elk Lick)		7	0+
Interval		40	0
Coal smut.			
Interval		50	0 (?)
Limestone,	Berlin.	2	0
Clay, yellow	Berlin.	1	6
Coal,	Berlin.	0	2
Limestone,	Berlin.	1	6
Fire-clay		1	6
Shales, red		2	0
Sandstone		5	0
Limestone (Harshberger)		5	0
Coal smut.			
Sandstone		25	0
Interval		29	0
Sandstone and shale		10	0
Black slates		5	0
Coal		1	1
Shales		10	0
Sandstone		10	0
Interval		39	0
Shales, brown		18	0
Coal smut.			
Fire-clay		?	
Limestone		2	0
Interval		40	0
Creek level at Forwardstown.			
Total		351	7

It is an interesting question how far these rocks correspond in their entirety to the Barren Measures which make up the Berlin region, or to the same series at other points in the county where the basins are sufficiently deep to include them.

In view of the fact that the soft, crumbly and easily disintegrated rocks of the Barren Measures cover up so deeply all their outcrops as to render complete sections difficult to obtain,

it would not be correct to say that a perfect identification has been established between the Forwardstown and Berlin sections. But though the evidence be not perfect, yet there can be little doubt that the highest limestone of the Forwardstown section is the *Elk Lick Limestone*, that Berkey's coal is the *Elk Lick coal* (at this point 40 feet above its limestone instead of 20 to 25 feet, as in the Berlin basin) and that the three limestones below the Elk Lick limestone represent the three underlying limestones of the Berlin region.

The coals of the group (excepting the Elk Lick coal), which at Berlin are workable beds, are here only thin seams, generally entirely covered over and not seen at all at their outcrop.

It is hardly necessary to remark that the *nickel ore* discoveries of this region have no foundation whatever in fact.

The assumption that scarcely a trace of nickel or copper or any like metal occurs in all these rocks is a moderately safe one, and the search after them here can result only in the sacrifice of time and labor.

Along the Bedford Pike.

Coal developments are further found on the eastern flank of Laurel Hill (First Great Anticlinal Axis) a few miles west-north-west of *Jennertown*. Such openings as have been made are confined to the property of *Mr. Jno. Haines*, who has demonstrated that all the workable coal beds of this locality belong to the Lower Productive group. Moreover it seems probable that in the interval between the school house at the cross roads, and the outcrop of coal a short distance west of Mr. Haines' house, all the beds of this group from A to E outcrop.

The Barren Measures have almost wholly disappeared, the sharp rise of the measures north-westward from the synclinal axis bringing the lower rocks speedily to the surface.

The Barren Measures extend, however, nearly as far west as the school house at the cross roads. In fact these measures cover here almost the whole basin, which does not exceed at this point seven miles in width. The lower coals are found only on the flanks of the anticlinals, and the Pittsburg seam misses the highest knobs in the deepest part of the basin, certainly by as much as 200 feet. The exposures along the pike

are sufficient to show the extent of the Barren Measure rocks, even if the general topography of the country were not alone enough to indicate their presence. The exposures show that the Barren Measures stretch over this undulating plateau from the school house, eastward to the village of Jenner Cross Roads.

Haines Mine.—Considerable coal is taken from the bed worked by Mr. Haines a few hundred yards north-east of his house. The bed is parted by a small slate band running through it, but the main bench averages nearly three feet thick, and can be profitably mined for home consumption. The coal is soft, of columnar structure, and shows reasonably well. The dimensions of the bed are as follows:

Black slate.			
Coal	from 2′ 6″ to 3′ 0″		
Slate	0 2		
Coal	0 6	3′ 8″	
Slate	?		
Coal	?		

It could not be definitely determined whether the coal seen in the road one-fourth of a mile west of Mr. Haines' house underlies the bed mined by him or not. In all probability it does, in which event Haines' mine would be on bed B, for the Conglomerate appears only a short distance beyond the outcrop in the road. From 100 to 110 feet above the Haines mine a "4 foot" bed of coal was once opened.

This is said to be underlaid by a ferriferous limestone 6 feet thick. One hundred feet higher a third seam of coal occurs, represented by Mr. Haines to be 5 feet thick. The intervening measures are concealed.

Mr. Haines' farm forms a part of the extreme western outcrop of the Lower Productive coals in the Johnstown sub-basin.

Beyond Mr. Haines' house the Pottsville Conglomerate is on the flank of Laurel Hill, reaching nearly to the summit. The formation, as here exposed, is made up chiefly of fine-grained sandstone, but fragments of rocks are found consisting of smooth, rounded white quartzite pebbles of variable size.

The top of the mountain is a broad flat, on which the Mauch Chunk Red Shale (XI) comes to daylight. Before the centre of the anticlinal is reached the "Mountain limestone," the base of the latter formation, rises above the surface.

Jenner Cross Roads.

The village of Jenner Cross Roads is situated on the top of the high land which skirts the western bank of Quemahoning creek. It has been stated above that the Barren Measures extend eastward as far as the village, but Quemahoning creek here flows through a valley sufficiently deep to expose some of the Lower Productive coal beds.

The beds seen in the immediate neighborhood of Jenner Cross Roads belong to the *Freeport group.* And it would seem that the entire group, consisting of three members, is here present.

Covode Mine.—The uppermost of the beds is opened on Dr. Covode's property just south of the village. The hillside over the mine furnishes but little cover, excepting to the north-west, in which direction the measures incline at too sharp an angle to allow of the coal being followed down the dip; but the excellent slate roof has kept the coal hard and good nearly to its outcrop, and the bed can thus be mined around the brow of the hill along the strike of the rocks. The following vertical section shows the thickness of the bed, as shown in the mine, together with the nature of the rocks immediately overlying:

Surface stuff	2′	0′	
Coal smut	0	2	
Sandstone and shales	6	0	
Shales, sandy	2	6	
Sandstone	4	0	
Black slates	3	6	
Coal, (including 0′ 2′ of bony coal, from 3′ 0″ to	3	2	
Slate	0	1	
Coal	0	5	4′ 2″
Slate	0	1	
Coal	0	5	
Fire clay.			

The bed seems to be of uniform quality, but the small slate parting must add largely to the percentage of ash in the coal, even with careful mining. Testimony confirmatory of this was obtained from persons in the neighborhood who have used the coal for domestic purposes.

The main bench however yields a bright, rich, lustrous coal, which appeared rather free from impurities, and if mined alone

would doubtless produce a much better fuel than is yielded by the average of the whole bed.

The coal is of columnar structure, its great friability causing it to crumble considerably in mining.

The mine very recently fell shut at the mouth and has not been re-opened; no specimen of the coal could therefore be obtained for analysis.

Sixty (?) feet below Covode's mine a second seam of coal outcrops. A thorough examination of this crop was at one time made with a view of determining the thickness of the seam. It is reported to have measured three feet from roof to floor. The bed is overlaid by a mass of black slates, 6 feet thick.

Underlying this seam is a deposit of ferruginous limestone the thickness of which has never been definitely ascertained. But it was sufficiently opened up to prove its character. Dr. Covode states that several attempts have been made to calcine this limestone but that each attempt proved more or less unsuccessful, as the rock did not slake well. The reddish cast of the half calcined fragments which were picked up in the field indicated the large amount of iron the rock carries in composition.

Possibly this is the Middle Freeport limestone; but it is far more probable that it represents the next band below, namely, the Lower Freeport. The coal outcrops in the road a few hundred feet north of the old openings on Covode's farm show two seams of coal below the one mined by Covode, the road outcrops being separated by an interval of perhaps 30 feet. These are thought to be the lower members of the Freeport group.

The lower Freeport limestone is quarried by *Mr. Beam* further south, and it has there been satisfactorily proved that the topmost layer of the deposit is most free from iron and all other impurities.

This deposit, however, undergoes marked changes in composition, and is not to be relied upon to produce rock of the same character, even at short intervals.

From these outcrops the coals rise south-eastward, across the Quemahoning, striking into the top of the ridge which here constitutes the Viaduct anticlinal sub-axis.

Beaver Dam Run.

Near the mouth of Beaver Dam run, Mr. Wm. G. Griffith has opened up the Upper Freeport (?) coal bed. The coal is here about 75 feet lower than at Covode's mine.

A measurement of the bed near the face of the drift gave precisely the same results as were obtained on Dr. Covode's property.

Specimens of silicious iron ore were shown by Mr. Griffith, who claims that a band of the same material, 2 feet thick, in one solid bench, underlies the fire-clay in the floor of his mine. No openings, however, existed on the ore, and nothing further can be stated in reference to it.

Griffith Mine.—The complete section of the coal bed, showing the thickness of the fire-clay deposit on which it rests, is as follows:

Fig. 87.

Black slate.				
Coal (2 inches bony coal,)	3′	0″	3′ 11″	
Slate	0	1½		
Coal	0	5		
Slate	0	1½		
Coal	from 0′ 4″ to 0	5		
Fire-clay	3	0		
Iron ore (?) reported, but not seen	2	0		

South-west of the village of Jenner Cross Roads the hillside, composed almost entirely of Barren Measure rocks, rises for 300 feet above the Quemahoning, and is prettily terraced to the top.

The coal bed (Upper Freeport?) mined by Dr. Covode is just above water level at the bridge about three-fourths of a mile south-west of the village.

Quemahoning Creek.

The Quemahoning forks a short distance above Gallagher's mill, one branch leading south-south-west to its head springs on top of the Viaduct anticlinal axis in Somerset township. The other fork leads westward towards Beam's mills. Along this latter branch no coal seems to occur, at all events in Jenner township; but in following up the bed of the other stream lower rocks than those seen in the neigborhood of the mill are

soon encountered, the measures rising south-eastward faster than the creek bed.

The Lower Freeport coal, as a workable bed, appears above water level for a considerable distance along the banks of this stream.

The bed, moreover, continues associated with the band of ferriferous limestone, which, though impure, is nevertheless invariably welcomed by the farmer, the soil of the region requiring constant fertilization to enable it to be tilled with profit.

Few openings however have been made on the bed in this vicinity. One well regulated mine and quarry will supply all the coal and lime needed for a tolerably large area of country; and the supply can be furnished at less cost to the farmer than if he took it from his own land, not to speak of the better character of the material supplied. Where farmers undertake to open a coal bed or to quarry limestone the work is usually badly done, and poor coal, at a comparatively high price, is the result of the experiment. And with respect to this particular limestone, which requires hard and thorough burning to drive off the carbonic acid, an efficient draw kiln is necessary to produce satisfactory results. In many cases where the limestone has been condemned as utterly worthless the failure to obtain the desired lime is due to crude and inefficient calcining rather than to the character of the rock.

Coal Bed D and the Ferriferous Limestone.

Beam Mine.—Near the head of a small run, an affluent of the south-east fork of the Quemahoning, the Lower Freeport coal and limestone have been opened on the property of Mr. John Beam.

Both coal and limestone are here extensively operated. The drift on the coal, 80 feet above water level, by barometer, is worked to the south-east (S. 40° E.) and rises gently, allowing the water to drain off easily.

In the main bench the coal is good, being unusually free from pyrites. It shows a peculiar combination of horizontal and vertical laminæ, the latter form of structure being confined chiefly to the centre of the bed. A thin band of slate divides the coal unevenly into two benches, as is shown by the following section:

Fig. 83.

Black slate	5' 0"		
Coal	4 0	4' 8"	
Slate	0 2		
Coal	0 6		
Slate and clay	0 6		
Limestone	5 0 seen.		

A specimen of the coal was forwarded to Harrisburg for analysis, and there showed the following constituents (A. S. M'Creath):

"Water	.820
Volatile matter	17.235
Fixed carbon	74.881
Sulphur	.519
Ash	6.545
	100.000

Coke per cent, 81.945; color of ash, cream.

The coal is bright, shining, rather tender, and seems generally free from iron pyrites."

It is evident from this analysis that the specimen tested came from the centre of the bed. In the neighborhood of the roof and floor the coal is compact and firm, its toughness being due in great measure to the earthy matter mixed with it.

Two plainly marked benches show on the hillside which rises eastward from the mine. These benches have never been opened, and it is not known whether they are coal bearing. This section was examined late in the season, and all outcrops had been concealed by a light fall of snow. But the distances between the benches are suggestive of all the Freeport coals as follows:

Hill top.	
Interval	40' 0"
Bench. (?)	
Interval	70 0
Bench. (?)	
Interval	50 0
Beam's mine.	
Total	160' 0"

The limestone is quarried from the face of the bench and burned in a large kiln near by. A grayish lime, slightly tinged

with red, is produced from it. This lime is largely used by the farmers in the neighborhood, who speak highly of its qualities as a fertilizer.

The deposit is separated into three layers by thin bands of impure fire clay shale. The limestone layers are very nearly of equal thickness, the whole aggregating about 7 feet from top to bottom; the strata of fire clay shale are persistent and continuous, and maintain an average size of about 6 inches. These features are thus minutely related in consequence of the interesting difference in the composition of the several limestone layers. This wide difference of composition is not betrayed by the general appearance of the hand specimens. All the layers are of a dark color, minutely crystalline, firm, compact and hard. But careful chemical analysis shows that the *central band* is by far the most impure, and is, strictly speaking, *a magnesian limestone*, with as much as 8.5 per cent of carbonate of iron and 12 per cent of silicious matter. The lowest layer is also impure, and in the same way, but to a less degree, while the uppermost stratum yields a limestone containing more than 90 per cent of carbonate of lime.

This is a rather curious combination. The intervening bands of shale undoubtedly indicate breaks in the deposition of the calcareous matter. Each layer is separate and distinct, and it is perfectly possible, even in spite of the regularity of the deposit and firmness of the rock, that a chemical process of dolomization has here taken place; but it is far more probable that the bands were deposited in the condition in which they are now found.

The following analyses by the Messrs. M'Creath show the nature of each layer:

	Upper.	Middle.	Lower.
Carbonate of lime	92.298	54.321	69.264
Carbonate of magnesia	1.483	23.088	13.773
Carbonate of iron	1.167	8.492	4.739
Carbonate of manganese	trace.	trace.	trace.
Alumina	.359	1.626	.403
Sulphur	.097	.127	.106
Phosphorus	.018	.051	.047
Carbonaceous matter	.550	.980	.590
Insoluble residue	3.950	12.020	10.760
	99.922	100.705	99.682
	A. S. M'C.	D. M'C.	A. S. M'C.

Pile Mine.—This same deposit of coal and limestone is also worked on the property of Mr. Jacob Pile, about one mile north-east of the village of Sipesville, in Somerset township.

The entire deposit, including the roof slates of the coal, has been handsomely exposed at this place. A complete and accurate section was therefore obtained as follows:

Black slate	from 5′ 0″ to	6′ 0″	
Coal		4 0	
Slate		0 1½	4′ 5″
Coal		0 1½	
Slate		0 2	
Limestone (in three benches)		7 0	

The coal is only fairly good. Directly under the roof and above the floor its structure is horizontal, the coal being intermixed with slate and carrying also iron pyrites. But the centre of the bed is of columnar structure and yields a much better coal; this portion of the bed is used by the blacksmiths in the neighborhood.

An analysis of a specimen from the more slaty portion of the bed gave the following results (A. S. M'Creath):

"Water at 225° Fah	.950
Volatile matter	16.540
Fixed carbon	71.206
Sulphur	2.409
Ash	8.895
	100.000

Coke per cent, 82.51; color of ash, gray.

The coal is shining, tender, with considerable mineral charcoal, iron pyrites and some slate."

The limestone is very extensively quarried by Mr. Pile, whose kiln almost entirely supplies the neighboring farmers with lime. An average specimen of the limestone gave the following results on analysis at Harrisburg. It will be observed from the analysis that the specimen, as selected by Mr. Pile, is very similar to that from the lowest layer of the same deposit on Mr. Beam's land near Jenner Cross Roads.

The specimen was analysed by Mr. David M'Creath

"Carbonate of lime	79.478
Carbonate of magnesia	10.222
Carbonate of iron, (with a little alumina)	3.639
Sulphur	.168
Phosphorus	.034
Insoluble residue	4.970

The limestone is compact, and of a bluish gray color."

Sipesville.

The little village of Sipesville is situated on top of an elevated plateau. South-west of the village the country continues as high land for several miles, and though slightly undulating, is usually nearly level.

This plain forms a part of the central water shed, which cuts Somerset county crosswise, and which has already been sufficiently described.

The township road, which skirts the northern borders of Jefferson township, follows along the top of this water shed. On one side of the road are the head springs of the Quemahoning flowing northwards towards the valley of the Conemaugh. On the opposite side numerous small runs take their rise and flow quickly down into Laurel Hill creek, which joins the Castleman at Confluence.

About one and a-quarter miles north of this road, and almost due west from Sipesville, a tolerably good bed of coal has been opened up on the farm of *Mr. Samuel Berkey*

The bed is nearly four feet thick, including two small but persistent partings of slate. The coal is used in the neighborhood and is much commended.

Queer Mine.—It is also mined on the adjoining property of Mr. J. Queer.

The full section of the bed is as follows:

Roof, black slate.			
Coal	2′	10″	
Slate	0	1½	
Coal	0	3½	3′ 8″
Slate	0	1	
Coal	0	4	
Slate			

No other developments whatever have been made in this region, and the identification of the bed was thus rendered uncertain.

The mines are situated a few feet above a small run, called the North Fork, and are about 2½ miles distant from Sipesville.

It seems probable, from the examinations made, that Messrs. Berkey and Queer are mining *bed E*, or the same coal as that once worked by Dr. Covode near the village of Jenner Cross

Roads. It should be stated, however, that this identification is necessarily conjectural, and more extended developments would be required to establish its correctness.

CHAPTER XIV.

Laurel Hill Creek.

Laurel Hill creek, or the North Fork of the Youghiogheny river, takes its rise near Indiantown, on the western slope of the ridge which marks the run of the Viaduct anticlinal along the eastern edge of Jefferson township.

From its headsprings the creek flows a general north-east course for at least five miles, which brings it to the high central water shed which runs across Somerset county. Here the creek is deflected, and instead of having forced a passage through the high land, it turns almost directly round upon itself, and returns again to within a few miles of its starting point; thence it continues south-west into Middle Creek township, and so on down the basin until its waters are mingled at Confluence with those of the Youghiogheny.

From Bakersville south-westward to the Turkey Foot, the creek flows close to the central line of the trough, but numerous bends in its course, sometimes a mile in extent, carry it east and west from the synclinal axis, thus varying the geology exposed along the valley. The bed of the stream is, however, throughout, confined to the rocks of the Lower Productive coal measures.

Generally speaking, the creek falls slowly. At *Bakersville* it is west of the synclinal axis, and flows over rocks that occupy positions high up in the scale of the Lower Productive measures. But in ascending the stream from Bakersville it is soon found to bend south-eastward, causing it to get into higher rocks, the natural effect of which is to throw the small but workable coals of the Bakersville region beneath the level of the creek. And this is in accordance with the fact that there is certainly a lack of coal between Bakersville and the Putman

school house, although it is entirely possible that the upper of the Bakersville beds remains above water level in all this distance, but has not been traced.

Descending the stream still further, the whole group of Lower Productive coals is found above water level at the point where the creek crosses the *mud pike;* and at the mouth of *Sandy run* the channel is filled with massive sandstone boulders, which indicate the presence of the Pottsville Conglomerate (XII) at daylight. Low cliffs of sandstone here line the banks of the stream, and a dense laurel thicket stretches up the slope for 75 feet, and follows the creek for a mile. But in view of the great preponderance of heavy sandstone at the base of the Lower Productive coal measures, as exposed along the Castleman river further south, and in view also of the entire lack of developments at the mouth of Sandy run, the exact horizon of the sandstone masses there occurring can not be asserted positively. Ascending the hills from the creek, softer rocks, holding a portion, if not all, of the Lower Productive coals, come in and spread over the country.

From Sandy run the creek flows south-eastward for some distance, and at the mouth of *Brown's run*, the heavy sandstone alluded to as probably belonging to the Conglomerate, has disappeared altogether beneath the bed of the creek. The ferriferous coal (D) and limestone are at water level on the eastern outskirts of the town of Ursina, and at this point the creek bends westward, the rocks dipping slowly with it as far as the synclinal axis, which crosses the creek in the vicinity of Confluence. Between Ursina and Confluence the creek passes over the highest rocks of the Lower Productive coal measures, and in this distance the Upper Freeport coal descends beneath the creek bed. This is fully discussed in the chapter giving the geology of this region in detail.

Bakersville.

In the vicinity of Bakersville, the mining of coal is confined to the western bank of Laurel Hill creek. East of the creek the country, for a considerable distance north-east and south-west of Bakersville, is covered deep with "Barren Measure" rocks which spread far up on the low ridge of the Viaduct axis.

The synclinal axis of this Johnstown sub-basin, which is here much narrower than in Cambria county, passes to the east of Bakersville, for at the latter place the rocks are already rising north-westward towards Laurel Hill. It is in fact due to this rather sharp rise from the synclinal, that even the highest coals of the Lower Productive series are found above water level in the Bakersville region.

The developments throughout this section show two small coal beds separated by about 70 feet of rocks. It is believed that these coals represent the upper members of the Freeport group.

Schäfer Mine.—At Schäfers mill, 1¼ miles north-east of Bakersville, the lower coal outcrops, only a few feet above a small run, which joins Laurel Hill creek a short distance below the mill.

The coal shows in this way (Fig. 89):

Fig. 89.

Black slate.....	....	1′ 0″	
Coal.....	....	1 10	} 2′ 6½″
Slate.....	....	0 ⅛	
Coal.....	....	0 8	
Slate.			

The bed has been but little worked, and the gangway has not yet advanced very far under the hill.

A persistent bench, higher up in the slope, marks the outcrop of the upper coal seam.

The outcrops are 60 feet apart, by barometer. The upper bed is claimed to have been once opened on this farm, and to have been found to be four feet thick. It is further reported to have shown two thin partings of slate.

Mull Mine.—The upper coal was more thoroughly opened up by Mr. Henry Mull, about three-fourths of a mile south-east of Schäfer's mill.

The mine has, however, been much neglected of late years, and being now in a bad condition, could not be entered. But a measurement of the bed was secured near the outcrop, with the following results (Fig. 90):

Fig. 90.

Black slate.....	from 3′ 0″ to	4′	0″	
Coal	.....	2	0	
Slate.....	.....	0	¼	
Coal.....	.....	0	1	2′ 11¾″
Slate.....	.....	0	½	
Coal.....	from 0 8″ to	0	10	
Floor ?.				

The coal in the upper bench appears to be tolerably good; it is soft and of columnar structure.

Neer Mine.—The lower bed is again mined on land owned by Mr. John Neer, about three-fourths of a mile south-southwest of Bakersville.

This mine is quite extensively worked. The bed is small, but a sufficient amount of the roof slate has been cut down in the gangway to allow of a suitable outlet to the coal. Small rooms have been run off from the main entry.

Moreover, the bed yields a good coal, which is said to ignite quickly, producing a hot fire. Mr. Neer's mine supplies nearly the whole of this neighborhood with fuel.

A thin parting of slate divides the bed into two benches, as is shown by the following section:

Slate.....	1′	0″	
Coal.....	1	10	
Slate.....	0	⅛	2′ 6⅛″
Coal.....	0	8	

This section is exactly the same as that obtained from the outcrop of the lower bed at Schäfer's mill.

Seventy feet above Mr. Neer's mine a distinct bench rises abruptly for about 15 feet. This is said to be coal bearing, an opening on it having once revealed a coal bed four feet thick.

Black Fossiliferous Limestone.—Due east of Bakersville, on the farm of *Mr. Miller*, on top of the narrow loop of land formed by the curve of Laurel Hill creek, a thin band of impure argillaceous limestone has been quarried in the past, but the openings are now closed.

This limestone, which is of a dirty black color, two feet in thickness, and filled with fossils, occupies a position in the "Barren Measures," but its horizon, as here determined by barometer, does not accord with the position of the Black Fossiliferous Limestone of other regions, and it is more reasonable that

the levels, (barometrical,) should in this case be discarded as being at variance with more reliable data. The stratum is a well known deposit further west, having been frequently recognized by Prof. Stevenson, and it appears moreover, in the sections of the Final Report. In these sections it is shown to occur regularly about 150 feet above the Upper Freeport coal bed, and this may also be its position at Bakersville, though the interval is probably in excess of that figure in the latter neighborhood.

This limestone must not be confounded with the *Crinoidal* or green fossiliferous limestone, which occurs about 150 feet higher in the measures. A specimen of the black limestone, secured from the old quarry of Mr. Miller at Bakersville, was carefully examined by Professor Stevenson, who recognized in it an *Orthoceras*, which is unknown in the higher or Crinoidal limestone. Moreover, Professor Rogers states that a species of Orthoceras is abundant in the black limestone at Pittsburg, which goes still further to establish the horizon of the Bakersville specimen, although it should be stated that the barometrical levels would rather make it the Crinoidal deposit.

The limestone is said to calcine quickly and easily, but produces an impure argillaceous lime. It extends far to the south of Bakersville, but has never been traced along the hills, although its outcrop has been partially opened at various points along the creek.

The creek is both narrow and shallow where it crosses into Middle Creek township; the channel is here away from the sandstone, and the smooth, low banks of the stream are made up of soft shale. In the neighborhood of the *Putman school* the creek has a gentle fall, and winds slowly and silently through a succession of maple groves; beyond this the stream soon becomes noisy, falling rapidly over the sandstones at the base of the Lower Productive measures.

Putman Mine.—On P. Putman's farm a small bed of coal is worked a short distance from the bridge which spans the creek at the Putman school house. This coal is about 30 feet above the water and shows the following section in the mine (Fig. 91) made by Chas. A. Young:

Fig. 91.

Dark slate roof.

Coal.....	.....	2′	6″	
Slate.....	from 0′ 1″ to	0′	3″	3′ 3″
Coal	.....	0′	6″	

The parting slate is persistent and of irregular thickness.

In all probability the bed represents the Upper Freeport coal, which was identified positively further down the creek, appearing there as a "4-foot bed."

The Putman coal may, however, belong to a small bed which ranges about 50 feet above the Upper Freeport coal, and which is persistent throughout this neighborhood, having been traced for a considerable distance along the hillside. It may here be remarked that such an horizon is by no means an infrequent one for a small bed about two feet thick; a bed of about this thickness and occupying this position in the measures having been opened and worked on Hoover's farm, one and a quarter miles south-west of the town of Somerset. (Chap. IX, p. 164.)

Barron Mine.—On Josiah Barron's land, about one mile south-west of the Putman mine, bed E or the Upper Freeport coal, has been opened a few feet above a small brook which flows westward into Laurel Hill creek. The bed has been quite extensively wrought by Mr. Barron, and yields, it is said, a superior quality of coal. The mine is now partially closed, but was entered in the autumn of 1875 by Mr. Young, who obtained the following section (Fig. 92):

Slate.

Fig. 92.

Coal, bony.....	.....	0′	3″	
Coal, good	.....	3′	6″	4′ 0″
Coal, bony.....	.....	0′	3″	

Floor unknown.

The mine is at the base of a low hill composed of Barren Measure rocks; near the top of this hill, and 50 feet above the mine, a small coal, two feet thick, has been opened. The drift was an experimental one to test the thickness of the bed, and was driven only a few yards beyond the outcrop. It has since fallen shut.

At Barron's place, Laurel Hill creek flows close to the synclinal axis, but a short distance to the west of the central line;

hence on the opposite side of the creek, coal beds lower in the series than those above described, come to daylight along the streams, which latter, heading on the top of Laurel Hill mountain, flow quickly down into the creek running along the centre of the basin.

Of these small streams Fishing run, Roaring run, and Gary's run, are the most prominent in this immediate vicinity, and quite a number of coal openings have been made in the ravines drained by them.

Thus a small bed of coal, stated by Mr. Young to occur in the Conglomerate of XII, (Mount Savage bed?) was long ago opened on the *Chorpenning tract*, between Roaring run and Laurel Hill creek.

This coal, enclosed by massive sandstone, is described by Mr. Young as of very variable thickness, and of a slaty, pyritous character. The average height of the seam is given as 2′ 3″.

A handsome show of carbonate iron ore is also reported by Mr. Young as showing on Roaring run.

A section was made farther south, at the point where the clay pike crosses Laurel Hill creek. This section extends from the bridge westward up the high slope which stretches towards Laurel Hill, and embraces, apparently, all the important coals of the Lower Productive series. It reads as follows (Fig. 93, Page Plate XIV):

Laurel Hill Creek; Clay-pike Section.

Hill top.		
Interval	50′	0″
Coal smut, rich crop, bed E. (?)		
Interval	65	0
Coal smut, bed D′. (?)		
Interval	40	0
Black slates.		
Coal	3	0
Fire clay, bed D,	1	6
Coal	2	0
Fire-clay	2	0
Limestone in layers	6	0
Fire clay, crop.		
Interval	100	0
Black slate and coal crop, bed B. (?)		
Interval	43	0
Sandstone	2	0
Slate	1	0

Coal	1′	6′
Interval	35	3
Creek level.		
Total	352′	3′

This section, which in the intervals between the coals varies very little from the typical Allegheny Mountain section, applies to the country bordering Laurel Hill creek from King's Bridge all the way through Upper Turkey Foot township, and nearly as far as to the mouth of Brown's run.

Only partial openings have been made on these coals by *Mr. King*, but the excavations made at his place are sufficient to establish the thickness of the beds.

Bed E.—The openings are now, for the most part, wholly closed up, but Mr. King reports the highest coal of the section as 5 feet thick. No information could be gathered respecting the condition of the bed.

Bed D′.—The thickness of the central bed of the Freeport group is not definitely known. Mr. King reports it as a "4-foot seam," but this is perhaps somewhat exaggerated from having been measured at the outcrop. The Middle Freeport coal rarely exceeds 3 feet in thickness within the limits of the First Great Basin.

Bed D.—The next lower bed was at one time drifted in upon and mined, but the opening is now closed up. Mr. King reports the bed as having yielded, on an average, about 5 feet of coal, separated into two benches by a thick band of impure fire-clay shale. Considerable coal was taken out, and as a fuel for domestic purposes it is said to give entire satisfaction, igniting easily and burning freely. It is possible, however, that the bed carries a tolerably large amount of iron pyrites, if one may judge from an opening on the same seam further down the creek.

The Ferriferous limestone is found in place, at a short interval below the coal. The band is here nearly 6 feet thick, divided as usual into three separate and distinct layers, parted only by an inch or two of shale. The limestone has been quite extensively quarried, and furnished an impure lime, adaptable only for agricultural purposes. An outcrop of fire-clay was observed directly below the limestone.

Bed B.—About 100 feet lower in the measures a promising show of coal smut very probably marks the outcrop of bed B. But this outcrop has never been investigated, and the thickness of the seam is therefore unknown. Judging from the extent of the outcrop the coal is apparently of workable size.

Bed A (?).—The lowest coal of the section outcrops about 45 feet still lower, and is 35 feet above the creek. This is presumably the outcrop of bed A, but as the interval between the outcrop and the creek has never been explored, this identification can only be made provisionally. The coal has been imperfectly opened up on Mr. King's land, and is described as a double seam, parted by about 2 feet of sandstone, the bed yielding in all upwards of 3 feet of coal. The old drift is now entirely closed up, but as much as 2 feet of coal show at the mouth of the mine, overlaid by black slate, as shown in the section. Whether the sandstone parting prevails over any great distance is not known; it may be presumed, however, that it does not, being probably replaced by fire-clay or slate.

Mr. Sam'l Dickey's farm is on the opposite side of the creek, and about three-fourths of a mile east-north-east of the developments last described. At this place attention has been chiefly directed to one small coal bed, not exceeding two feet thick, which was found to be underlaid by a limestone stratum of about the same thickness. The deposit is about 100 feet above the water, and represents, probably, bed D′, the rocks having descended somewhat in the interval between King's and Dickey's. The coal opened by the latter may, however, belong to bed D. Further developments are necessary to establish this definitely.

The country separating the deep valley of Laurel Hill creek, from that of Middle Creek to the east, is a high undulating plateau, which contains the highest rocks of the basin. Certainly as much as 250 feet of Barren Measures are here represented, 150 feet of these rocks being exposed along the clay pike, on the hill just east of Mr. Dickey's house. A section made on the pike at this place shows a few thin streaks of coal and an abundance of reddish fire-clay shale, but no lime-

stone. This is a noteworthy fact when considered in connection with the Berlin section.

Limestones of the Barren Measures.

But higher up on the Laurel Hill plateau, two limestone strata, from 60 to 75 feet apart, are found on *Mr. Josiah Gross' property*, some distance to the north of the clay pike. The upper of these bands was estimated to overlie the Upper Freeport coal (as identified at the Putman school house) by at least 250 feet, and caps the hill, being found only over a narrow area confined to the centre of the basin.

It is the upper band that is worked by Mr. Gross, and though the deposit is small it yields a good stone, which requires little treatment in the kiln and yields a moderately pure lime. The deposit is "stripped," there being little cover to interfere with this method of working. The face of the stripping gives this section:

Slate	10′	0″
Fire-clay	2	6
Limestone	2	0 seen.

The limestone is of a bluish cast and fossiliferous.

Of the limestone band from 60 to 75 feet lower down in the measures, little or nothing is known on the Gross farm. It is reported, however, to have been once opened up there, and to have shown a trifle thicker than the limestone on the crest of the hill.

It is not probable that either of these bands corresponds with the Black fossiliferous limestone found in the high land to the east of Lavansville, but known more especially on the Miller farm. The Gross limestones come in above this, the one now worked by Mr. Gross being close to the horizon of the Crinoidal or Green fossiliferous limestone, a deposit which has been found by Professor Stevenson to prevail further west with great persistency.

Going eastward across the New Lexington plateau, into the valley of Middle Creek, nearly all of the Lower Productive coals are there found above water level at the point where the creek is crossed by the clay pike.

Partial developments have been made which establishes this fact; and by the aid of these openings and a few outcrops

along the face of the hill to the east of the mill, the following rough section was constructed:

Vertical Section on Middle Creek.

Hilltop, sandstone on surface.		
Bench, bed D′ ?		
Interval	40′	0″
Bench, outcrop, bed D.		
Interval	50	0
Bench ?		
Interval	70	0
Coal crop, bed B.		
Interval	25	0
Fire-clay.		
Interval	15	0
Black slates and coal crop, bed A.		
Interval	15	0
Middle creek.		
Total	215′	0″

The stream is here enclosed by tolerably high hills, which run close to the water. The rocks dip plainly to the north-west, and the coal in the western slope of the valley cannot be mined by drift at this place without trouble with the drainage.

Frieze Mine.—A short distance north of the mill Mr. S. Frieze exposed *bed D* near the top of the hill. Three feet of coal were uncovered, 6 feet of limestone showing a few feet below. Ten feet of dark shale (black slate ?) rest on top of the coal seam.

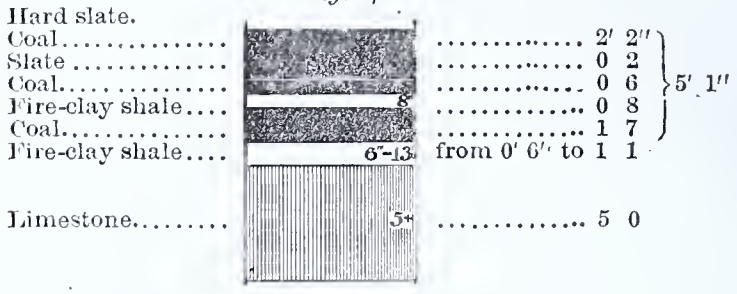
The bed was traced without difficulty round the hills to the point where the above section was made.

Ascending the hill eastward from this mill, towards Centreville, the Mahoning sandstone shows on the top of the slope; but it soon passes out into the air, and fails to cross (under cover) the Viaduct anticlinal sub-axis at Centreville.

Faidley Mine.—Returning again to the valley of Laurel Hill Creek, and descending the stream from the clay pike, *bed D* and the *ferriferous limestone* are again seen on the property of Mr. A. Faidley, about three miles south of the King farm. A very complete exposure has here been made of both coal and limestone, the deposit being, by barometer, 125 feet above the creek.

The section of the mine is as follows:

Fig. 94.



The section shows the bed to consist of three benches, an unusual occurrence, and one worthy of especial mention.

The coal from all three benches is impure and firm, mining out in cubical blocks. The coal in the lowest bench is particularly hard and compact, being bedded in horizontal layers, and much intermixed with earthy matter.

The opening was only recently started, but in driving the gangway south-west, has exposed a leaning of the rocks in that direction, the measures inclining at an angle of about 1°. And the sinking of the basin can also be observed by following any particular bed south-westward from Faidley's. The different elevations above the water that are thus obtained for the same bed at different points along the creek, are due partially, of course, to the windings and turns of the stream, but the persistent sinking of the whole basin to the south and south-west, is made very manifest by the levels.

Descending the hill from Faidley's mine, a small seam of coal shows 30 feet below the mine, and 65 feet still lower occurs a mass of rusty shales with iron ore balls, below which is a peculiar conglomerate, composed of rounded fragments of carbonate iron ore held firmly together by silica. Directly below this, a band of limestone was accidentally uncovered. The stratum is certainly two feet thick, and may be noted as an unusual occurrence, for limestone is rarely seen at this horizon in the First basin. No coal is exposed in connection with it. Twenty feet below the limestone a ledge of thin sandstone, 10 feet thick, rests on top of a mass of black slates, which extend to the creek level.

One hundred feet above Faidley's mine there is an outcrop of limestone, and about one hundred feet still higher a workable vein of coal has been opened, but the mine is now shut. This latter seam is probably the "Rose coal bed," developed along Brown's run, further south. A cliff of sandstone caps Faidley's hill, a few feet above the old opening on the highest coal bed.

Bed D is further mined, a trifle higher in the hills, on the *Schroch property*, some distance north-west of Faidley's, which gives the normal rise of the rocks at this place as *north-west* and Faidley's mine, as described, shows a rise of the synclinal to the *north-east.*

Nearly all of Upper Turkey Foot township is composed of high land. Both the Viaduct anticlinal, and the synclinal of the Johnstown-Confluence sub-basin, run through this township, but as the anticlinal does not here elevate the Pottsville Conglomerate to the surface, the entire township may be said to be underlaid by coal. Much of this coal is far below the surface, but a large amount is above water level, and can be attacked at the outcrop in the deep valley of Laurel Hill creek, and to some extent also in the shallow ravines drained by the smaller streams which head up on the ridge of the Viaduct sub-axis, and flow westward into Laurel Hill creek.

Brown's Run.

Brown's run is one of these subsidiary streams, and the hollow down which it flows has become known through the operations of the Pittsburg and Baltimore Coal, Coke and Iron Company. In the ravine, which broadens and deepens rapidly towards Laurel Hill creek, are exposed the rocks between the Lower Freeport coal bed (D) and an horizon about 200 feet above the Upper Freeport coal, (E,) in all, therefore, about 300 feet of measures, while further south, in the neighborhood of Ursina, still higher rocks come in, as is described further on.

Krieger Mine.—About one mile above the mouth of Brown's run, the highest workable coal seam of this section of country was long ago discovered, and was there opened up just above water level. This is the "Old Krieger bank," which was worked for a considerable space of time, and from which a large

amount of coal was extracted. The bank has been in disuse for a number of years, but is still in good condition.

The opening shows a bed of coal 6 feet thick in one solid breast, a thickness which is maintained without any important variation throughout the entire drift. For the most part the coal is bright, soft and unusually friable, requiring very little effort in mining, being easily brought down by the pick, and needing no blasting. The bed shows handsomely *in the mine*, but a close inspection of a number of hand specimens almost invariably reveals a damaging amount of iron pyrites, existing as minute scales and sometimes as lentieular plates, which add so largely to the percentage of sulphur that the coal cannot be accorded a high rank. But sometimes the bed exists in a remarkable state of purity over a short area, and yields then a superior quality of coal. That this cannot be relied upon over extended areas has been most fully and clearly established by the operations of the Pittsburg and Baltimore Coal, Coke and Iron Company, near the mouth of the run, where an extensive mine was opened and worked for some time, but was subsequently abandoned on account of the unsatisfactory results attained. The following analyses of specimens from the Krieger bank will serve to express more clearly what has just been said respecting the character of the coal.

Analysis No. I was made by Professor P. Frazer, Jr., in 1871. It shows a minimum of sulphur and a very low percentage of ash. Should the bed run in this condition, nothing better could be desired for steam purposes, and as the coal cokes easily, it would of course produce a very superior quality of coke. The analysis is as follows:

I.	"Water	0.55
	Volatile substances	17.17
	Fixed carbon	79.25
	Sulphur	0.47
	Ash	3.11
		100.55

In the above analysis the sulphur is considered exclusively as a constituent of the ash.

Analysis No. II was made by Mr. A. S. M'Creath, chemical assistant of the survey. It reveals a very different condition

of things; it shows three per cent of sulphur, and that too existing, as before stated, in the form of minute scales, which would pass through a "washer" with the coal. It is believed that this analysis represents more nearly the average condition of the bed. The result of Mr. M'Creath's analysis was as follows:

II. "Water	.920
Volatile matter	22.950
Fixed carbon	66.999
Sulphur	3.096
Ash	6.035
	100.000

Coke per cent, 76.13; color of ash, gray, with red specks.

The coal is bright, shining, very tender, with numerous thin partings of iron pyrites and considerable sulphate of iron."

At the Krieger mine the coal is overlaid by tough black slate, and the coal is firm and dry; it rests regularly upon fire-clay, as shown in Fig. 95, as follows:

Fig. 95.

The main gangway of the mine was driven south-east, and rises perceptibly, but in one place an attempt was made to drive north-westward, and the steady incline of the basin in that direction thus became apparent. Over the mine the hill rises fully 125 feet and is crowned by sandstone.

Rose Mine.—The "Rose bed," so named from an opening about to be described, can be traced from the Krieger opening along the north bank of the stream to the mouth of the run, where, as before stated, the Coal and Coke Company opened this drift. The bed is here about 200 feet above water level and 150 feet *lower* than at the Krieger mine.

The "Rose bank" starts in on a course of N. 30° W., and shows a steady rise, occasioned partly by a local roll in the floor, which reduced the bed in a short interval to one-half its normal thickness. This roll, moreover, shows on the eastern side of the gangway to a much greater extent than on the

western wall. The gangway parts a short distance beyond the mouth of the mine, one entry running nearly due west and sinking somewhat, while the other entry was driven on a course of N. 30° W. and rises slightly.

But the rise here to the *north-east* exceeds all others in steepness; attempts to mine towards the south-west having been in every case abandoned from necessity, and in one of the rooms run off in the latter direction, a dip of 3° was seen, although this is doubtless entirely local.

The gangways are wide, commodious and well ventilated.

The coal was opened by the Coal and Coke Company at its crop, near the terminal point of the hill, and the Rose mine shows a very inferior bed, subject to frequent rolls and of variable thickness. Unlike the Krieger mine, the coal is overlaid at the Rose bank by crumbly shale, which affords poor protection from percolating waters, and the bed is often much troubled by the moisture. Moreover, the coal is much more slaty and pyritous than at the Krieger mine, and attempts to coke the coal, as mined in the Rose bank, failed totally to produce a satisfactory article.

The bed averages 5 feet thick, but from developments that have been made in the country round about, it would seem that no reliability can be placed upon it to maintain a workable thickness even over short areas. Thus, it is not known on the south side of the Brown's run ravine, opposite the Rose bank, nor has it yet been found at Ursina, while it appears in the Harnedsville and Fort Hill sections only as a thin streak of coal, not exceeding a foot in thickness. There seems then no escape from the conclusion that this Barren Measure coal, perhaps identifiable with the lowest Berlin coal, (Philson bed,) which is about 100 feet above the Upper Freeport coal, cannot be depended upon over large areas either as maintaining workable dimensions, or, when of workable thickness, as yielding steadily a marketable fuel.

The following section of the bed, as it appears in the Rose bank, (Fig. 96,) is here appended (Chas. A. Young):

Fig. 96.

Roof, clay slate, Coal, bony	from 0′ 4″ to 0′ 6″		
Slate, pyritous	0	½	5′ 0½
Coal	from 4′ 0″ to 4	6	

Specimens of both the coal and coke were forwarded to Harrisburg, and there gave Mr. A. S. M'Creath the following constituents:

I. Coal.

"Water at 225°	1.555
Volatile matter	23.480
Fixed carbon	63.483
Sulphur	4.037
Ash	7.445
	100.000

Coke per cent, 74.965; color of ash, pink.

Iron in coal	3.276	
Sulphur as FeS_2	3.744	
"Free" sulphur	.293	
Sulphur left in coke	2.694	Coke made from above coal in Laboratory.
Per cent of sulphur in coke	3.590	
Per cent of ash in coke	9.790	

The coal is shining, with small partings of charcoal, and contains a very large amount of pyrites and slate."

Mr. M'Creath further analysed two specimens of the coke made by the company from this coal, in Beehive ovens. The results are herewith appended without comment:

	I. (A. S. M'C.)	II. (D. M'C.)
"Water at 225°	.930	.160
Volatile matter	1.585	2.000
Fixed carbon	86.620	86.824
Sulphur	2.259	2.701
Ash	8.606	8.315
	100.000	100.000
Color of ash	red, with white specks.	red.

The coke is porous, dull, dirty, slaty and iridescent."

Variability of Barren Measure Coals.

The difficulties met with in mining on the Rose bed at this place present some curious features.

The variability of all coal beds is well known. Some beds are more stable than others; the Pittsburg coal bed, for example, running usually for long distances almost without chang-

ing in size, appearance and character. Yet even in mining the Pittsburg bed one place at least is known where between two good collieries another colliery opened upon it has proved a total failure, the coal turning out to be variable in size and poor in character.*

The coals of the Lower Productive system show this tendency to variation very strongly; and already in these volumes of reports on Clearfield, Cambria and Somerset counties, there have been given numerous striking instances of rapid swelling or degradation of coal beds.

And the coals of the Lower Barren measures, lying between the Lower and Upper Productive systems, are much more treacherous, when they are found of great size, than the coals of either the Upper or Lower series.

For the normal condition of the Barren Measure coals is to be small and worthless, just as the normal condition of the Productive coals is to be of workable size. It follows therefore, that for a Barren Measure coal to be workable over any given area is as much of a departure from the regular custom as for a Productive coal to be worthless over any given area.

But we naturally look to see the Productive coal return to its normal state and size: and equally naturally we look to see the Barren Measure coal return to its customary practical insignificance.

When the Brown's run region was examined by the writer several years ago (1871) the Krieger bank was open and showed over six feet of handsome-looking coal. Fresh coal was mined and sent on for analysis. The report of the chemist was very favorable to the coal, the percentage of sulphur being unusually low.

The Rose mine was opened at the mouth of the run, one mile below the Krieger mine; it was not driven in very far under the hill nor had much coal been mined from it. Fresh coal was also taken from the working face of this mine and forwarded for analysis.

The report of the chemist again was favorable, the percentage of sulphur running very low.

*Prof. Stevenson mentions this case as occurring on the Upper Monongahela.

The hopeless entanglement caused by the identification of the Ferriferous limestone of Somerset county with the Ferriferous limestone of the Allegheny river, as had been done by the First Survey, and accepted ever since, rendered an error almost unavoidable in this case. For 200 feet below the Rose bed a mine was opened, showing coal and ferriferous limestone, while the average distance from the Upper Freeport coal to the ferriferous limestone is about 230 feet on the Allegheny river.

It was not until the present survey of Cambria and Somerset counties had cleared away the cloud from the actual condition of the measures in the First basin, that it became apparent that the Rose bed was not the Upper Freeport coal bed, but a bed in the Lower Barren measures, lying fully 100 feet above the Upper Freeport coal.

The Rose bed, though variable as to size and uncertain as to character, is extremely persistent, and is found at numerous places, though usually small and worthless, from the western base of the Allegheny Mountain at Berlin as far west as Allegheny county.

This explanation of the horizon of the bed throws light upon the results of the operations of the company, results most unexpected and disastrous.

For this bed which showed at two openings, over one mile apart, as a large, handsome bed, its conspicuous bench running from one mine to the other, plainly marked on the hillside, and which gave in both mines a coal very free from sulphur, proved wonderfully treacherous, as the detailed report above has already stated.

New and extensive drifts at the Rose mine found horsebacks and sulphurous coal; the bed when followed down Laurel Hill creek only exists as a small coal, as it does also at Augustine's (near Brook tunnel) and over on the Castleman river near Harnedsville.

Where the coal is last seen going under the hill at the Krieger mine, with abundance of cover, it is a fine, handsome bed, though evidently sulphurous in places. The coal extends in an unbroken sheet under this high hill for hundreds of acres, or even a thousand; and if it holds the size as showing in the Krieger mine there is coal enough to last a colliery for very

many years. For at the Kreiger mine the bed is over six feet thick; or 10,000 tons of coal to the acre. But the region should be carefully explored, and the coal touched by shafts or bore holes to find its size and character under the hill, before any farther permanent plant is put down on Brown's run.

While the developments of the company present the Rose bed as singularly variable, even among uncertain beds; yet the case is paralleled by this same Rose bed (Philson bed of Berlin) and other overlying beds of the Barren Measures, which are workable coal beds from Berlin to the Blue Lick; but after going under the hill on the south side of the Blue Lick only come out on to the Castleman as small and worthless seams.

Brown's Run.—An interval of about 200 feet occurs between the Rose bed and the water level at the mouth of Brown's run. In this interval two seams of coal have been found. The first in descending order is the Upper Freeport, which occupies a position about midway between the Rose bank and the run. Its outcrop is visible in the sides of the incline plane, which was used by the company to lower the coal from the Rose bank to the coke ovens at the base of the hill.

Rush Mine.—This Upper Freeport bed has never been explored on the company's property, but was partially opened at the old Rush mine on the western bank of Laurel Hill creek, $1\frac{1}{3}$ miles above the mouth of Brown's run, where it is just above water level, and shows about $2\frac{1}{2}$ feet of inferior slaty coal. It is almost directly overlaid by heavy massive sandstone, which represents, perhaps, the Mahoning sandstone deposit; its floor could not be seen, but the bed is reported to rest upon massive sandrock, without a particle of intervening fire clay.

An analysis of this coal, by Prof. Persifor Frazer, Jr., is herewith appended, being taken from a professional report on these lands by Prof. J. P. Lesley. The analysis is as follows:

"Water	0.45
Volatile substances	17.65
Fixed carbon	55.58
Sulphur	——
Ash	26.77"

It was unnecessary to determine the sulphur in the specimen, inasmuch as the coal is utterly condemned by the enormous amount of earthy matter included in it.

Croll Mine.—The lowest workable coal above water level at the mouth of Brown's run is *bed D*, or the Lower Freeport coal. This was once opened near Widow Croll's house, at the mouth of the run. It is here represented as a double bed about 25 inches thick, parted by 3 inches of slate near the centre. Its roof is iron-stained shales, above which the Freeport sandstone comes in, and shows 30 feet thick. This sandstone is very distinct at the mouth of Brown's run, and notably so at the place where the coke ovens of the company were established.

An analysis of a specimen from Widow Croll's mine gave these results to Prof. Frazer:

"Water	0.55
Volatile substances	21.90
Fixed carbon	60.98
Sulphur	0.62
Ash	15.95'

This shows a great freedom from sulphur, but the large amount of ash is ruinous to the value of the coal.

Ursina.

This same bed, one of the most persistent of all the seams in the Lower Productive measures in Somerset county, continues down Laurel Hill creek, falling equally with the stream, and is found just above water level on Mr. Noah Scott's farm, on the outskirts of Ursina.

Scott Mine.—The bed shows its characteristic slate parting, and the limestone by which it is invariably underlaid throughout this section of country has also been exposed and quarried on Mr. Scott's farm. It is highly ferriferous and yields an impure reddish lime. The thickness of the limestone stratum is not known exactly, but it certainly amounts to as much as 4 feet.

The coal bed *sinks* at once below the creek in going westward from the Scott mine, and is under water level at the Ursina bridge, but reappears beyond Confluence to ascend the slope of Laurel Hill; it is known to exist at Draketown, in Lower Turkey Foot township.

The coal *rises* steadily, but very gently, east and south-east from the Scott mine towards the Viaduct anticlinal axis, the centre of which is in the neighborhood of Fort Hill station, on the Castleman river. Following the bed in that direction it is exposed at *Brook tunnel* on a level with the railroad, which is perhaps as much as 100 feet above its level at Scott's.

It was once mined at the mouth of a small ravine, near the tunnel, on land now owned by *Mr. Hoblitzell*, but the opening was afterwards abandoned and fell shut. The bed is reported to exist here 4 feet thick, parted by a persistent band of fire-clay shale. The high land of the "Hog Back ridge," separating Laurel Hill creek and the Castleman river, rises above the mine and shows two evenly-rounded and persistent terraces, which clearly mark the presence of the Upper Freeport coal and the Rose bed.

The rock cutting at Brook Tunnel reveals nothing of economic interest. The exposures at the western approach show 25 feet of black slates overlaid by a thin layer of broken sandstones. These rocks are almost directly below the Lower Freeport coal, which should appear at the top of the cut, but has been carried away by eroding waters and replaced by clay and surface stuff. The rocks are here rising perceptibly to the south-east, and at the eastern end of the tunnel, (1,600 feet in length,) the black slates have ascended to the top of the cut, and are underlaid in this way

Massive sandstone	15′	0″
Coal	0	6
Impure fire-clay shale	15	0
Railroad grade.		
Interval to Castleman river	115	0
Total	145	6

The *Upper Freeport coal bed* is also known in the vicinity of Ursina, but as at the Rush bank, so it is again at Ursina, too small and probably too slaty to be of any practical importance. At Ursina, however, it is associated with a small stratum of moderately pure limestone which comes in almost directly below the coal. This is the Freeport limestone, a well known deposit throughout the Bituminous coal regions, but one which, curiously enough, does not seem to prevail either in the Berlin-Salisbury sub-basin or in the Somerset sub-basin; nor is it

known at Johnstown, which occupies geologically almost precisely the same position as Ursina, and is in the same sub-basin.

Railroad Cut Coal.—The limestone is seen in a railroad cut directly above the Scott mine, 100 feet of measures intervening between the two. It is 2½ feet thick, as follows:

Fig. 97.

Massive black slates.

Coal		2′ 0″ to	2′ 6″
Shale	1′	1	0
Limestone	2′ 6″	2	6

The slates and shales overlying are perhaps 30 feet thick, and carry in them concretionary nodules of carbonate iron ore. The nodules are too thinly scattered through the shales to possess any practical value.

The Upper Freeport coal was again identified on the eastern bank of Laurel Hill creek, about midway between Scott's mine and the mouth of Brown's run. It is high above the water, and shows 2½ feet thick, the coal resting upon fire-clay shale. It goes below the water level just west of Ursina.

The highest rocks which range along the synclinal of the Johnstown-Confluence sub-basin pass out into the air on their eastern outcrop at Ursina. These rocks contain little of practical importance, the few thin streaks of coal, however, serving a valuable purpose as horizons in the measures. These coals cannot be satisfactorily identified with the Berlin beds, with the single exception of the Rose seam, 100 feet above the Upper Freeport bed. As elsewhere stated, this Rose seam does not exist at Ursina as a workable bed; at all events it has not yet been proved to be such. But the Ursina section shows a thick limestone capping the hill, and this limestone, 480 feet by barometrical measurement above the Lower Freeport coal bed, falls in place for the *Elk Lick Limestone*, and has already been identified as such in chapter X of this volume.

The following vertical section (Fig. 98, Page Plate XIV) embracing 500 feet of measures, shows the Elk Lick limestone as the top rock of the high land at Ursina. The section was constructed by Franklin Platt in 1871, and is reproduced

from a geological report of Prof. J. P. Lesley to the Pittsburg Coal and Coke Company. The section reads as follows:

Vertical Section at Ursina.

Sandstone, thin		5′ 0″
Shale		2 0
Limestone	5 0	
Fire-clay shale	0 6	
Coal smut	0 3	
Impure fire clay shale	Elk Lick Limestone. 1 6	
Coal smut and slate	1 0	
Limestone	10 0	
Shales		35 0
Black slate outcrop.		
Shales		20 0
Sandstone		20 0
Slates		22 0
Slaty coal		1 6
Interval		50 0
Sandstone, thin bedded		25 0
Shales		40 0
Sandstone		30 0
Slates, dark, with calcareous nodules		38 0
Coal		6 0
Shales, olive		20 0
Sandstone, flaggy		25 0
Shales		15 0
Sandstone, flaggy		20 0
Dark shales		20 0
Coal		2 0
Shale		1 0
Limestone		2 0
Interval		20 0
Sandstone, thin bedded		15 0
Sandstone, heavy		30 0
Slates		8 0
Coal, two benches, with parting		5 0
Fire clay, with ore balls		3 0
Limestone, ferriferous		5 0
Laurel Hill creek.		
Total		503′ 9″

The Elk Lick limestone is separated at Ursina into two layers. The upper band has never been worked, but the lower stratum, 10 feet thick, is quite pure, and yields a much superior quality of lime to that obtained from any of the deposits in the Lower Productive measures as exposed at Ursina. It ranges along the top of the high plateau west of Ursina and covers the country overlooking Confluence, spreading for a con-

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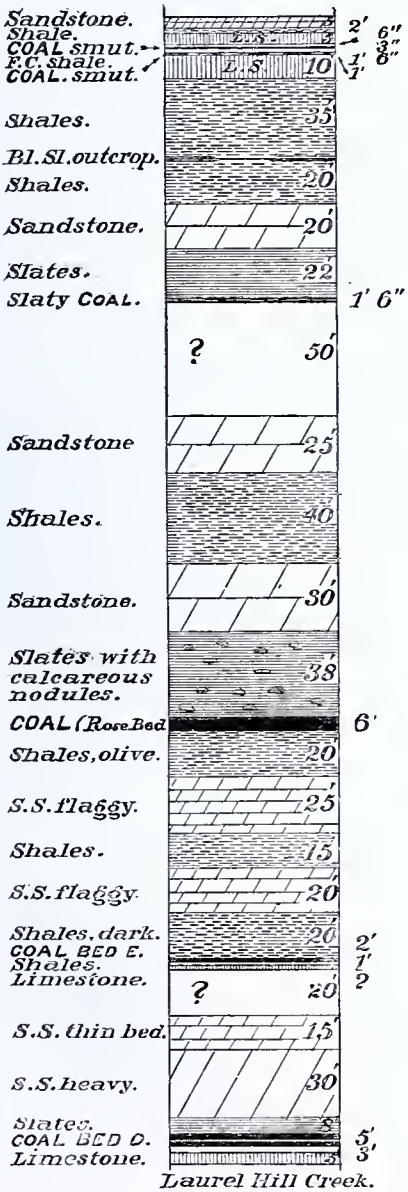
1876

Fig. 98.

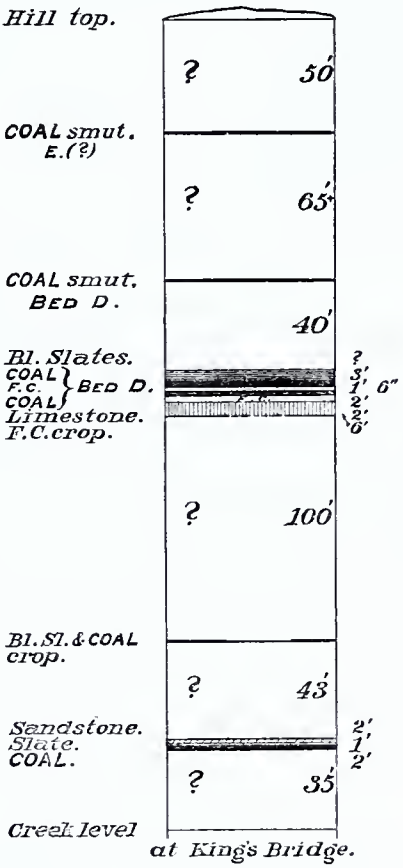
Ursina.



Laurel Hill Creek.

Fig. 93.

Laurel Hill Creek.



at King's Bridge.

O. B. HARDEN, DEL.

siderable distance to the north-east and north-west of the latter town, which is situated close to the synclinal axis of the basin.

Notwithstanding its great height above the water at Ursina, it is profitably quarried by the coal company, being lowered to the railroad by an incline plane. It is calcined in a fine large draw kiln on the outskirts of the town.

At the company's quarry it shows as a double deposit, with an intervening streak of coal, as follows:

Thin sandstone	5′ 0″
Shale	2 0
Limestone	5 0
Fire-clay shale	0 6
Coal smut	0 3
Impure fire-clay shale	1 6
Coal smut and black slate	1 0
Limestone	10 0 +
Total	25′ 3″

A specimen of the lower band was forwarded to Harrisburg for analysis, which resulted as follows (D. M'Creath):

"Carbonate of lime	90.803
Carbonate of magnesia	2.738
Carbonate of iron, (with a little alumina,)	1.986
Sulphur	.084
Phosphorus	.048
Insoluble residue	3.740
	99.399

The limestone is exceedingly compact and brittle, with conchoidal fracture, minutely crystalline, and showing a few specks of iron pyrites. Its color is bluish gray."

Scarcely a trace of the Johnstown iron ore deposit is found at Ursina. And no workable band of ore seems to exist in all the 500 feet of rocks above water level in this vicinity. But abundance of good iron ore is claimed to have been found on the opposite side of the "Hogback ridge," and is elsewhere noticed.

In conclusion, it may be mentioned that a persistent and distinct coal bench, overlaid by sandstone, is easily traced along the road leading from Ursina to Confluence. This bench descends to the water level at the latter place, where it is reported to contain as much as four feet of coal. This bench is in posi-

tion for the Rose bed, which here possibly may appear with nearly the same thickness as on Brown's run; but if its quality is the same as at either the Kreiger or Rose mines, it is only of value for domestic purposes.

CHAPTER XV.

Detailed Description of the Mines and Developments along the Castleman River and on White's Creek in the Johnstown-Confluence Sub-basin.

At Fort Hill station, close to the central line of the Viaduct anticlinal sub-axis, huge boulders of the Pottsville Conglomerate show, not only in the bed of the river, but far up on the hillsides. The massive sandrock exposed in the railroad cut directly east of the station is a part of Formation XII.

Fort Hill.

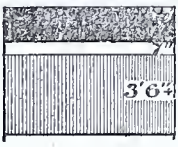
Fort Hill is a high dome-shaped mound on the left bank of the Castleman river; its top is composed of a succession of beautifully rounded coal measure terraces, falling steeply but regularly towards the shallow ravines which widen into the Castleman valley from the south, and insulate the hill from the surrounding country. The evenness of these terraces and the regularity of their slope afford a striking and beautiful illustration of the slow erosion of our coal measures, and of the formation of "benches" by alternate layers of hard and soft rocks. The top of the mound is a smooth circular flat, embracing several acres of ground; it is composed of the rocks which almost directly overlie the Upper Freeport coal, the hill rising nearly 500 feet above the Castleman river, and including the entire Lower Productive coal group.

Only the highest coals and limestones of this group have been opened up. Bed E, or the Upper Freeport coal, is not the only coal bed of workable thickness; but as it can be mined in connection with its underlying limestone, and as this limestone not only calcines much more easily than that from the ferriferous deposit, but also produces a much superior quality

of lime, this coal naturally engages attention to the exclusion of the other coal beds.

Leslie Mine.—It has only recently been opened by Mr. Leslie, the present owner of the land, and the deposit when seen was not wholly exposed. It showed, however, this section:

Fig. 99.



Black slate and rusty shales	10'	0"
Coal	1	6
Fire-clay shale	0	7
Limestone	3	6+

The deposit has upwards of 70 feet of cover, and underlies the whole hill.

Bed D has also been mined on this property, 120 feet, by barometer, below the opening on the highest coal. The bed is reported as existing here nearly 4 feet thick, unequally divided by a band of indurated shale varying from 2 inches to 6 inches in thickness. The upper bench, it is said, will average 3 feet of solid coal. Its character could not be ascertained, the mouth of the drift having recently caved in. Mr. Leslie reports the ferriferous limestone as having been exposed at one time almost directly below the coal mine.

Between this opening and the river there is an interval of 300 feet, one-half of which is composed of coal measure rocks. These have remained wholly unexplored, the base of Fort Hill being wooded land.

But on the opposite side of the river a section of these measures was obtained, on Mr. Augustine's farm, about midway between Fort Hill station and Brook tunnel, (Fig. 100, Page Plate XV). Only partial openings have been made on the coal beds, but sufficient has been seen to establish the presence of the entire Lower Productive group, and as much also as 100 feet of Barren Measure rocks on top. The thickness of the coals, as given in the section, rests mainly on the authority of Mr. Augustine. An interesting feature is the presence of the Rose bed, 9 inches thick, which appears in its usual place, 100 feet above the Upper Freeport coal. The section is as follows (Fig. 100, Page Plate XV):

Vertical Section Opposite Fort Hill.

Hill top.	
Interval	50′ 0″
Coal, Rose bed	0 9
Interval	100 0
Coal, bed E	2 0
Shale	1 0
Limestone, Freeport	3 0
Interval	115 0
Coal, bed D	?
Interval	40 0
Bench.	
Interval	70 0
Bench, fire-clay.	
Interval	55 0
Coal	thin.
Interval	15 0
Coal, bed A (?)	4 0
Interval, heavy sandstone boulders on surface	100 0
Coal, Mount Savage (?)	1 0
Castleman river level.	
Total	556 9

The lowest coal of the section is at the water's edge and cannot be mined. It is enclosed by walls of massive sandrock, the coal being extremely hard and tough. It has been mined to a small extent at very low water, and its thickness thereby ascertained. This coal clearly belongs in the Conglomerate, and may perhaps represent the *Mt. Savage coal bed.*

A cliff of massive sandstone, 20 feet high, rises above the water at this point, and on continuing up the hill large sandstone boulders cover the slope nearly as far as to the outcrop of bed A, which comes in just below the railroad track. Among the loose fragments at the river are pieces of a curious iron ore pudding stone, similar to that already noted on Laurel Hill creek, where this same rock was seen in place in the interval between coal beds B and D.

The coal opened by *Mr. Augustine*, near Brook tunnel, 100 feet above the river, is presumably bed A, and therefore corresponds with the seam exposed in the railroad cut at Shoo Fly tunnel. The old opening on Mr. Augustine's farm was worked quite extensively and with entire satisfaction, until the mine was thrown shut by the grading of the railroad. Mr.

Augustine asserts that the bed is four feet thick, and further claims that an excellent quality of coal was mined.

The next bed in ascending occurs 70 feet higher, the smut of the coal alone showing; and a thick band of silicious fire clay has been exposed by Mr. Augustine. The coal comes in almost directly above the fire clay, being exposed 2 feet thick on the railroad a few hundred yards west of the fire-clay opening.

Bed D shows one hundred and ten feet still higher. This seam has been largely mined by Mr. Augustine, who reports it a "four foot bed," parted near the centre by a thin band of shale from 2 inches to 6 inches thick.

Very thorough search has been made for the ferriferous limestone, but the efforts have not been successful. The limestone appears in its accustomed place beneath the coal at Ursina, and is moreover reported to have been found by Mr. Leslie on the opposite side of the river. It is therefore extremely unlikely that it is absent from the Augustine farm, especially as it seems to have been discovered by Mr. Seehler on the adjoining property to the east.

An interval of 100 feet intervenes between bed D and the Upper Freeport coal, the Middle Freeport bed having never been exposed on these hill slopes. It may possibly come in at its regular horizon 40 feet above bed D, and have escaped detection, inasmuch as the hills have never been systematically developed.

Bed E shows, as on Fort Hill, 18 inches thick. The limestone has not yet been found by Mr. Augustine. In the Fort Hill section the coal was seen to rest almost directly upon the limestone; this is clearly not the case on the Augustine farm, but it is hardly probable that the limestone has disappeared totally, as is popularly supposed, and it will doubtless be found beneath the thick band of fire clay which here, as is usually the case, intervenes between the coal and limestone.

The Rose bed makes a distinct bench on the hillside about 100 feet above bed E. It has been thoroughly investigated by Mr. Augustine, and found to run only 9 inches thick, but on *Mr. Wm. Snyder's* land, a short distance east of the Augustine farm, the same bed is reported as showing two feet thick. Mr.

Snyder has also opened both the Lower and Upper Freeport coals, the beds showing their characteristic features. Limestone is quarried from beneath the Upper Freeport coal.

At Brook Tunnel the river by a short turn sweeps southward, and the railroad, which has followed the Castleman from Meyersdale, here takes leave of it, passing under the "Hogback ridge" on to the waters of Laurel Hill creek, which it then follows to the Turkey Foot.

The measures exposed in the cut at the eastern end of Brook Tunnel have been already given with the detailed description of Laurel Hill creek.

Between Brook Tunnel and Harnedsville, to the south-west, the country is almost wholly undeveloped. Not only the whole Lower Productive group of rocks, but a considerable amount also of "Barren Measures," are in the hills throughout the entire distance, but no openings have yet been made in them. Iron ore is reported as occurring on Cucumber or Bear run, which joins the Castleman about midway between the tunnel and Harnedsville. The ore is found in the Lower Productive rocks, and when opened up some years ago was measured by Franklin Platt, at that time on a professional visit to this region. The ore was fully one foot thick, and merited further investigation.

Harnedsville.

At Harnedsville three coal beds of the Lower Productive series have been opened on the left bank of the river, the developments being almost wholly confined to the lands of Mr. Jno. Hanna. A short distance south of Harnedsville the same coals are found in the hills skirting White's creek, and are described further on.

The Harnedsville section (Fig. 101, Page Plate XV) shows, though only imperfectly, the principal contents of the hills in that vicinity. It includes the Elk Lick limestone, 480 feet above the Lower Freeport coal, Harnedsville being close to the synclinal and surrounded by high hills. In detail the section is as follows:

Vertical Section at Harnedsville.

Limestone, (Elk Lick,)	10′	0″
Interval	255	0
Black slate crop, Rose bed.		
Interval	112	0
Coal, bed E	2	0
Fire clay shale	1	0
Limestone	2	0
Interval	105	0
Coal, Shale, Coal — bed D	2 1 1	6 0 2
Fire clay	2	0
Limestone	6	0
Interval	15	0
Limestone	1	6
Interval	58	0
Sandstone	8	0
Coal, bed B ?	2	0
Castleman river.		
Total	584	2

Near the Harnedsville Bridge a ledge of thin bedded sandstone, 10 feet in height, shows in the bank at the bend of the river. Underneath this sandstone a coal bed three feet thick is claimed to outcrop, and it is further asserted that the bed yields an excellent quality of coal, much preferred to that from any of the other beds thus far opened. Its close proximity to the water will prevent it from being mined by drift, but small quantities have been extracted at low water during the summer. This outcrop probably represents bed B, of the Lower Productive series.

Hanna Mine.—The coal chiefly mined by Mr. Hanna occurs 100 feet higher in the hill, and clearly represents *bed D.* The ferriferous limestone has never been exposed by Mr. Hanna, but is quite extensively developed on the adjoining farm of Mr. M'Clintock, to the south. The measurement of the bed, as obtained at this latter place, will be found beyond. (See Fig. 102).

The mine on Mr. Hanna's property is now shut, and it is not known whether the whole of the bed was worked, or merely the upper bench. Three feet of coal resting upon fire-clay shale are claimed to have been exposed, which would rather indicate the presence of an additional bench below the floor of the mine, judging from the usual condition of bed D in this

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Fig. 101.

Harnedsville.

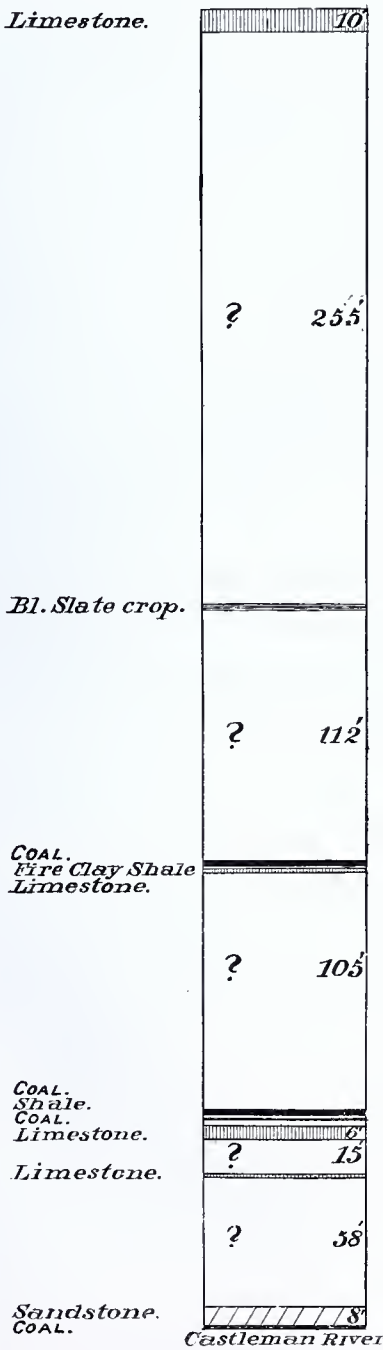
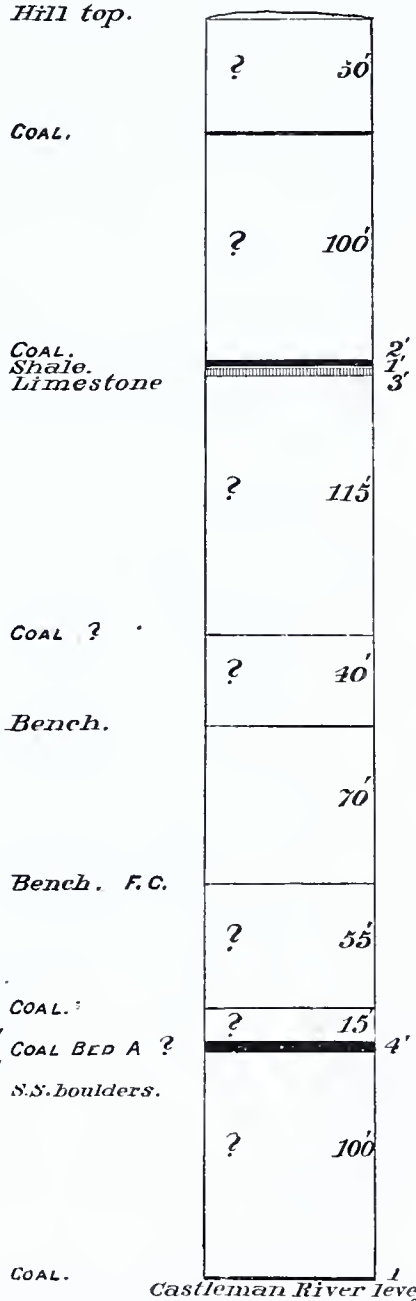


Fig. 100.

Opposite Fort Hill.



region. A specimen of the coal was analysed by Prof. P. Frazer, Jr., a few years ago, with the following results:

"Water	.041
Volatile combustible matter	25.24
Fixed carbon	61.14
Sulphur	trace.
Ash	13.21
	100.00

Ash, yellow gray, with black slag like beads, colored with metallic oxides."

Bed E.—One hundred feet above the latter mine the Upper Freeport coal, or bed E, was opened in a shallow ravine, two feet of coal having been exposed, underlaid at a short interval by two feet of good limestone. One hundred and ten feet still higher the bench of the *Rose bed* is plainly marked near the top of Hanna's hill.

The slow and steady incline of the rocks north-westward from Harnedsville, buries the measures, (with the exception, perhaps, of the Rose coal,) beneath the bed of the river before the synclinal or central line of the basin is reached in the neighborhood of the Turkey Foot.

White's Creek.

The headwaters of White's creek, a tributary of the Castleman, are on top of Negro Mountain, near the southern limits of Somerset county. It descends rapidly westward through a deep and beautiful gap of the Winding Ridge (the Viaduct anticlinal sub-axis), and at Listonville turns sharply northward to join the river at Harnedsville.

The valley of the creek is a narrow gorge through an unbroken succession of high hills. The bed of the stream for a long distance is far below the coal bearing rocks, the measures of Formation XI, (Mauch Chunk red shale,) being exposed at Waas' saw mill, near the centre of the Viaduct anticlinal.

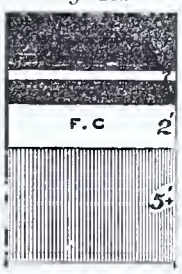
The coals first approach the water in the vicinity of Listonville, bed B going under water level at the western extremity of the village, but the creek keeps close to the base of the Lower Productive group all the way to its mouth.

Starting at the mouth of the creek, with the coal beds already described in connection with the developments on the

Hanna property at Harnedsville, we find the Lower Freeport bed worked on the adjoining farm of Mr. M'Clintock.

M'Clintock Mine.—Both coal and limestone are mined in considerable quantities, the limestone, though ferriferous, being nevertheless adaptable for agricultural purposes. A complete section of the deposit was obtained as follows:

Fig. 102.



Slate	10′	0″	
Coal	2	0	3′ 6″
Bony coal	0	6	
Fire-clay shale		?	
Coal	1	0	
Fire-clay	2	0	
Limestone	5	0 +	
Total	20′	6″	

Analyses were made by Prof. P. Frazer, Jr., of specimens from both the upper and lower benches of this bed as here exposed. The upper bench yields an unusually pure coal, the sulphur and ash forming together only 3½ per cent of the whole; the lower bench, on the other hand, is both slaty and pyritous.

The analyses are as follows:

	I. Upper Bench.	II. Lower Bench.
"Water	0.35	0.30
Volatile matter	22.25	19.64
Fixed carbon	73.08	66.74
Sulphur	0.81	6.28
Ash	2.71	7.34

I. Ash, light yellow gray, arenaceous.

II. Ash, blue gray, firm, pulverulent, gritty; iron abundant in ash."

An interesting feature of these analyses is the difference in the amount of hydro-carbon gases in the two benches, the lower bench having nearly 3 per cent less volatile matter than the coal above the fire-clay parting.

An unusually large interval apparently here intervenes between the upper and lower benches of the coal bed. The two benches were not seen at the same place, and the fire-clay interval could not be measured exactly.

The coal in the upper bench is soft and much intermixed, but serves very well for calcining the limestone, which is burned roughly in open air heaps at the quarry.

At the mouth of the mine a lenticular mass of carbonate iron ore was seen in the roof slates; it almost directly overlies the coal.

At an interval of 100 feet above the mine, the *Upper Freeport coal* outcrops, its underlying limestone being also fairly exposed.

The coal shows 2 feet thick, as on Mr. Hanna's land to the north; the limestone comes in just below and measures 3 feet thick.

Still higher up on the hill, a rich black slate crop shows at the foot of a distinct bench which caps the hill. This is doubtless the representative of the *Rose bed.*

These coals and limestones dip westward across the creek, and are found at lower levels on *Mr. Walker's property.* The upper bench of bed D is here worked, yielding 3′ 6″ of good coal. The roof slates are firm and compact.

A band of limestone shows in the bed of a small run 25 feet below the mine. As much as 2 feet of the stone have been exposed. This is an unusual horizon for limestone, and the stratum may possibly belong to the ferriferous deposit, an increased interval perhaps separating the coal from the limestone, as at M'Clintock's. But at M'Clintock's the interval between the two benches of the coal does not certainly exceed 10 feet, if it is as much as that, and it is therefore believed that the small band seen on Mr. Walker's farm is separate from the ferriferous limestone, and it is so represented in the Harnedsville section. A limestone band occupying a similar position in the measures is reported to occur at Castleman village, in the Somerset sub-basin.

Near *Mr. Cunningham's house*, about one mile above Harnedsville, a small seam of hard, firm coal, one foot thick, overlaid by 8 feet of tough black slate, has been exposed near the creek level. The black slates hold two persistent plates of carbonate iron ore, aggregating about 2½ inches of good ore. Directly above the slates is a cliff of massive sandstone, nearly 30 feet high. The small coal was estimated to underlie bed D by about 75 feet, and is possibly the representative of bed C.

Listonville.

Ascending the stream the next developments of importance are at Listonville, where beds A, B and D have been exposed by the Messrs. Liston.

Bed D outcrops near the top of the hill, and was only partially opened, the drift being now closed. The thickness of the coal is given as 5 feet, parted unevenly by a persistent band of shale, one foot thick. Just below the coal the ferriferous limestone has been opened.

Bed B is the coal which chiefly engages attention at Listonville. It is about 100 feet below bed D, and is a large seam, composed of bright shining coal, which presents a handsome appearance in the mine, but on closer inspection, reveals, like the Rose bed, a large amount of iron pyrites and slate. A specimen of the coal shipped to Harrisburg for analysis gave the following results, which require no further comment (A. S. M'Creath):

"Water	.910
Volatile matter	21.960
Fixed carbon	64.597
Sulphur	2.298
Ash	10.235
	100.000

The coal is bright, tender, and seamed with slate and iron pyrites."

The coal is mined by the Messrs. Liston 30 feet above the creek. The steep high hillside over the mine affords excellent cover, and the roof slates being tough and hard, the coal comes out firm and dry. The mine supplies almost the entire neighborhood with coal. The bed is in one compact bench, as shown by the following section:

Fig. 103.

The mine is driven north-east and is obliged to maintain this course, the steep dip to the north-west preventing it from being worked in the direction of the rise. At one place in the main gangway the force of the dip was measured and found to

amount to as much as 8°. This is due to a close proximity of the Viaduct anticlinal, which crosses White's creek about 1½ miles south-east of Listonville.

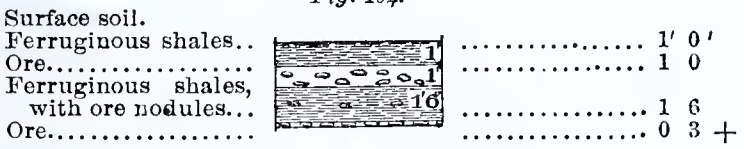
Bed B is also mined at the place where it goes under the creek, near the western end of the village. Its dimensions at this place are the same as in Liston's mine, but thin-bedded sandstone has taken the place of the black slates seen at Liston's, and rests directly upon the coal. The same bed is again seen in the western bank of a small run, one-fourth of a mile south of Listonville. It is there some 60 feet above water level, and a small subjacent coal seam, 18″ thick, underlaid by a band of fire-clay, is exposed just above the run. This is probably the outcrop of *bed A*.

The fire-clay stratum is 6 feet thick, and carries balls of carbonate iron ore. A few feet above the coal a ledge of massive sandstone appears in the bank of the run.

Listonville Iron Ore.—The most important mineral feature of the Listonville region is the important iron ore stratum, recently discovered about one-quarter of a mile east of the village. The full thickness of the deposit has not been exposed, a portion of the ore still remaining concealed beneath the water. But as far as the experimental stripping was carried, the ore continued as persistent bands enclosed in a mass of soft fire-clay shale, which would afford cheap and easy mining.

The ore mass is divided into two layers of unequal thickness, as shown by the following section:

Fig. 104.



The ore is silicious, as is shown by the large amount of insoluble residue in the analysis. It contains, however, a small amount of lime, but not enough to flux it; is smooth and of a dark color. It passes at once under water level in going west from the present opening, and is not again seen above the waters of White's creek, but rises steadily and rapidly towards the Viaduct anticlinal axis, and is doubtless near the top of the hill at Waas' saw mill.

Mr. D. M'Creath's analysis of the ore is as follows:

"Iron	22.700
Sulphur	.120
Phosphorus	.098
Insoluble residue	41.040

Carbonate ore, hard, compact, bluish gray."

This ore is in Formation XII, and is perhaps underneath the Piedmont Sandstone.

Limestone of XI.—Ascending the creek still higher, the narrow gap of Winding Ridge (Viaduct axis) is soon entered, and red shales (XI) make their appearance above water level. At Waas' saw mill the silicious limestone, near the base of Formation XI, is seen high above the water, and on *M'Cartney's land*, near the mill, this limestone has been extensively quarried for a number of years, having been largely used in making the National Pike, which enters the State a few miles south of the saw mill. That portion of the limestone deposit known as the "fossiliferous band" is quite pure, calcining very easily and yielding a fine white lime, much sought after for plastering purposes. The limestone band, averaging about 5 feet thick, is streaked with numerous seams of calcite which add largely to its purity. It is overlaid by several feet of reddish silicious limestone. The same deposit has also been exposed on *Mr. Waas' land* to the west, being there about 100 feet above the creek, but descending rapidly north-westward, it disappears under the water about one-half mile below the saw mill.

Chubb Run.

Returning again to Listonville, and passing southward over the high land and across the National Road, the tops of the hills are wholly made up of Barren Measure rocks. But continuing still further southward into a small ravine drained by Chubb run, which flows rapidly down into Maryland, the coals of the Lower Productive group are found on *Mr. Bird's farm*, close to the Maryland line.

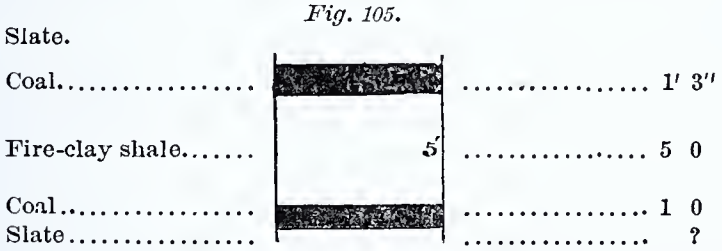
From the developments made on this property it is difficult to say which of the beds have been exposed, but it is probable that both B and D are represented.

The property is close to the Winding Ridge, and the beds descending rapidly from the air on a north-west dip, strike

into a line of low hills which skirt the eastern bank of Chubb run. The coals are almost without cover on the eastern bank, and an attempt was made by Mr. Bird to mine the Lower Freeport coal (?) on the opposite side of the run; but the steady dip interfere with the mining operations, and the coal could not be followed for any distance under the hill.

Bird Mine.—Only the outcrop of the bed was seen, and this shows an unusually thick parting of soft fire-clay, which maintains throughout an average thickness of 5 feet, the bed showing in this way:

Fig. 105.



With this thick parting of slate intervening between the benches of coal, the bed is almost worthless, and could not be profitably mined even for local use.

The outcrop of an 18 inch seam of coal was discovered just above water level near Mr. Bird's house. This same bed is reported to have been dug through on the opposite side of the run, and to have measured 4 feet thick. This may include, however, a considerable amount of slate. It was estimated to underlie the double bed opened by Mr. Bird by as much as 75 feet.

A 20 inch coal seam was further found by Mr. Bird about 100 feet above the mine, and a still higher coal bench was noted near the top of the hill. This section would indicate the presence of all the coals from *bed B* to the *Rose bed*, but these identifications cannot be accepted as absolute.

The town of Petersburg is situated on the top of the high Barren Measure plateau, which extends westward as far as the valley of the Youghioghcny, described in Chapter XVI.

The gradual change in the structure of coal bed D is very noteworthy. Throughout Cambria county, and all through the northern part of the Somerset county, the coal is invariably

in one solid bench, about 2½ to 3 feet thick, and without any parting.

On going southward through Somerset county, a small but regular parting is found in bed D, and the coal is always in two benches. These benches, as well as the parting, gradually increase in size, until, along the Castleman river, the bed measures in all 6 to 7 feet thick, and with a parting ranging in size from 12 to 24 inches. And finally, at the Bird mine (Fig. 105) the parting has grown to a thickness of 5 feet, at the expense of the coal benches, and the bed has become practically worthless.

The ferriferous limestone underlying the coal has not participated in any of the changes, but remains comparatively regular in size and character, and the chief key-rock to the geological horizon.

CHAPTER XVI.

Containing a Description of the Youghiogheny Gap of Laurel Hill, and also of the Mines and Developments in the Youghiogheny Valley as far South as Smithfield.

The Youghiogheny river makes the south-western boundary of Somerset county. Coming into Pennsylvania from the south, it flows a tortuous course as far as Confluence, winding sluggishly in broad and graceful curves around the horizontal rocks at the synclinal axis of the Johnstown-Confluence sub-basin. At the Turkey Foot it is joined by the Castleman coming in from the east, and Laurel Hill creek descending from the north, (the form of junction suggesting the Indian name long ago given to the confluence of these three large streams,) and thus reinforced, it starts directly across the measures, cutting through them as they rise in obedience to the First Grand Anticlinal axis, and leaves the county finally in the deep gap of Laurel Hill mountain.

Excepting in the region between this gap and Confluence—a small town at the Turkey Foot—the Youghiogheny Valley possesses little of economic importance. In the interval just indicated it flows in the Lower Productive Coal rocks, getting below them at the point where it enters the gap, and bringing the Piedmont sandstone to daylight.

Passing south of Confluence, the stream remains enclosed by lofty hills, from 300 to 400 feet in height, but the hills are almost wholly composed of Lower Barren measure rocks and seem to contain little of interest excepting the *Elk Lick limestone*, which for a considerable distance crowns their tops. The hills skirting the river are gashed here and there by small mountain streams descending from the east and west, forming

shallow ravines, which stretch far away to the mountain top. Portions of the deep narrow valley have been cleared of timber and are under cultivation, while other portions remain yet in a state of wilderness, the alternations in the wild scenery being of a pleasing character, and the effect often materially heightened by the graceful sweeps of the river.

The Youghiogheny gap of Laurel Hill is a deep gorge through the broad massive mountain, with sides rising from 800 to 1,000 feet above the water. The mountain is crowned by the Pottsville, or Seral, Conglomerate, and at the centre of the antielinal arch the river flows at the base of Formation X. Entering the gap from the east, the Piedmont sandstone at the base of the Lower Productive coal measures rises above the water, and is soon succeeded by the balance of the heavy conglomeritic sandrock composing Formation XII. The sharp north-west rise rapidly elevates these rocks, and at the 82d mile post on the railroad the red shales of Formation XI make their appearance in the side cutting.

Limestone of XI.—Continuing still deeper into the gap, the base of XI is reached at the 81st mile post, at which point the silicious limestone deposit belonging to this Formation outcrops in a bold cliff, and is largely quarried by *Mr. Isaac Hugus*, of Somerset. The fossiliferous portion of this deposit, as has been stated on a preceding page, produces an excellent lime, adaptable either for fertilizing or for plastering purposes, but the silicious bands, which form by far the greater part of the deposit, yield a sandy lime of little value. These bands have, however, been quite extensively worked and shipped to Pittsburg, to be used there in paving.

A species of marble, of a brownish hue and streaked with quartz, is here intercalated in the rocks near the base of Formation XI. This marble polishes handsomely, and would adapt itself quite well for purposes of ornamentation, but it yet remains to be shown that the rock exists here in quantities which would justify an attempt at its further development. Thus far it seems to have been found only in thin streaks.*

*Thin bands of a similar marble occur at the same geological horizon, at Keystone Junction, near the summit of the Allegheny Mountain, east of Meyersdale. It was there uncovered with a view of developing it, but the results obtained were not encouraging. On the eastern slope of the Alle-

Brief mention may here also be made of the granite supposed by some persons to exist in the heart of this mountain mass. All efforts to find this granite are to be discouraged, for it may be stated with great positiveness that no such thing exists at this place, nor anywhere above water level in our Bituminous Coal Regions. Hand specimens of a true granite were produced, but these emanated from some other locality.

At Mr. Hugus' quarry (Marble Hill) the rocks are still rising north-westward, and the centre of the anticlinal is some distance further down the river.

The coals sweep over the antielinal in one broad symmetrical arch, the top of which has been planed off in the lapse of time, and a large portion of the arch is now described in the air. The coals, however, stretch far up on the mountain flank and reach nearly to the crest. This is shown at Draketown, on Draketown run, a small stream descending southwards along the base of the mountain, and emptying its waters finally into the Youghiogheny river.

Draketown.

In the vicinity of Draketown the Freeport group is above water level, the lowest member of the group, bed D, being mined on a number of farms, and forming the principal bed of this section of country.

Tannehill Mine.—On Tannehill's property, at the southern outskirts of the village, the coal has been opened and shows as follows:

Slate and shale	5′ 0′	
Black slate, tough	1 0	
Coal	1 8	2 6′
Slate parting	0 2	
Coal	0 8	
Slate	?	
Coal	?	

Impure ferriferous limestone has been taken out from below the lower coal, but the opening having partially caved in, all of the deposit could not be seen. The limestone was roughly calcined and slaked unsatisfactorily.

gheny Mountain, one mile south of the Clay Pike, a band of "red marble 10 feet thick" is said to outcrop. This likewise occurs at the base of Formation XI, but whether it is identical with that found at Keystone Junction, and in the Youghiogheny gap of Laurel Hill, remains yet to be determined.

The coal also shows at a disadvantage, appearing both slaty and pyritous. It serves, however, quite well for domestic purposes, and as such fuel it is largely consumed, but is represented as unfit for the blacksmith's forge. At Mr. Tannehill's mine the bed dips at an angle of 3° to the south-east.

The hillside above the mine shows the *Middle and Upper Freeport coals* in their regular positions. The first occurs at a distance of about 50 feet above the mine; it is said to be underlaid by limestone, but has never been thoroughly investigated. The Upper Freeport bed comes in about 100 feet above bed D, and is marked by a persistent bench.

An exposure of a small coal seam, believed to underlie bed D, was seen on *Mr. D. Crossen's* land, three-fourths of a mile west-south-west of the Tannehill mine. The exposure occurs in the bank of Draketown run, the coal being small and unimportant; it appears as a double bed, resembling D somewhat, and may perhaps belong to the Lower Freeport, or bed D, though this seems improbable. The section is as follows:

Thin sandstone	5′ 0″	
Shale	1 0	
Sandstone	1 6	
Black slate	3 0	
Coal	1 8	
Slate	1 3	4′ 5″
Coal	1 6	

Still lower coals outcrop in descending the mountain flank from Draketown, and openings have been made on these beds at various points along the western slope of Laurel Hill, small streams cutting into the measures and giving access to the coals.

Going east from Draketown the country between Draketown run and Laurel Hill creek is high rolling upland, the top of which is covered with Barren Measure rocks. The synclinal axis of the basin runs through a portion of this high land, and along the synclinal the *Elk Lick limestone* comes in to crown the plateau. This furnishes an abundance of excellent fertilizing material, a fact also made manifest by the condition of the farms along this rolling land. But the rocks are well nigh devoid of workable coal beds, although small seams have been found, which on some farms have been opened and are mined. No systematic development of these hills has yet been made;

but sufficient has been done to establish the fact that the coals and limestones are at similar horizons to those at Berlin; and more complete openings will, it is believed, ultimately show that the sections are alike in all their main features.

The highest rocks are seen in the neighborhood of Mr. Jehu Rush's house, two miles north of the Turkey Foot. The developments on Mr. Rush's farm are by far the most complete in all this region, and the following section was there obtained:

Vertical Section at the Rush Farm.

Hill top.		
Coal, mined by Mr. Rush, Elk Lick (?)		2′ 7″
Slate		?
Limestone clay		?
Slate and coal smut		?
Shale		2 0
Limestone	Elk Lick Limestone.	3 0
Shale,		0 6
Limestone		3 0+
Interval		50 0
Limestone, impure		1 0
Black slate		10 0
Interval		15 0
Limestone (reported).		
Interval		55 0
Coal		1 6
Interval		30 0
Thin bedded sandstone		10 0
Creek.		
Total		183 7

The entire thickness of the limestone deposit on the hill top is stated by Mr. Rush to be over 10 feet. The rock is of a grayish color, moderately pure and yields a good lime.

The overlying coal bed, identified as the *Elk Lick* coal bed, about 200 feet below the great Pittsburg bed, is opened about 1,000 feet east of the quarry, and by barometer, 35 feet lower in elevation than the limestone, the difference being due to the eastern dip of the rocks. The mine is run in on a course of N. 30° W., and rises slowly; a room has been driven off nearly north, and rises also. The bed is small, and is half composed of slaty, bony coal, as shown by the following section (Fig. 106):

Fig. 106.

Fire-clay shale, crumbly		
Coal		1′ 3″
Coal, bony		1 4
Black slate.		

The mine is provided with very little cover, and the roof being soft and crumbly, the coal is rusty and poor. The lower bench carries fully 25 per cent of slate; mixed with the coal from the upper bench it serves very well for calcining limestone, for which purpose it is chiefly employed.

A vertical section, similar to that obtained on the Rush farm, was constructed on *Mr. George Krieger's land*, a short distance north of the Jersey Church. Here the Elk Lick Limestone was also found on the hilltops, and has been opened by Mr. Kreiger, though only imperfectly. It is reported to measure 10 feet thick. An 18 inch seam of coal was once worked on this farm 150 (?) feet below the limestone. This bed corresponds in geological position with the lowest coal of the Rush section.

The country falls away somewhat in going north from Mr. Kreiger's house, and as the rocks rise in that direction, lower measures soon come in and replace those at Krieger's. The highest limestone does not extend much beyond Mr. Krieger's house, and on Mr. Nickelson's farm, 1½ miles north-east of Draketown, a small bed of coal is worked near the base of the Barren Measures. The *Mahoning sandstone* undoubtedly outcrops at the school-house, one-half mile south-west of Mr. Nickelson's house, and the coal worked is closely associated with this sandrock deposit.

Nickelson Mine.—Possibly the coal is the representative here of the Rose bed; but if so, the bed has become much reduced from its thickness on Brown run.

In the Nickelson mine it shows:

Roof sandstone.			
Coal	1′	6″	2′ 5′
Slate	0	1	
Coal	0	10	
Hard fire-clay slate.			

The coal is moderately good and burns freely.

These rocks extend north-eastward across Sandy run, which cuts deep into the measures, exposing the lowest coals.

From Rush's farm the country sweeps south-west with little or no change in the general elevation, the Elk Lick limestone being traced along the hilltops and across the river into Addison township. Very little coal, however, is found along the plateau.

On *Youngkin's* farm, 1½ miles west of the Turkey Foot, a small coal seam 30 inches thick was once mined. The mine is now completely shut, but the coal is described as existing without persistent slate partings, and is otherwise moderately free from the usual impurities. The bed clearly belongs in the Lower Productive Coal Measures, but the opening is too isolated to permit of any satisfactory identification. The hillside, on which the mine was opened, is 300 feet high, and is indented with a succession of evenly rounded benches, all of which, however, remain unexplored. It is probable that the bed is near the top of the Lower Productive group.

The Conglomerate of XII appears in the bed of the Youghiogheny river just below the mouth of Draketown run. Between this point and the Turkey Foot all the Lower Productive coals rise successively above water level and occupy positions on the slopes. The hills have never been sufficiently investigated to allow of a measurement of the beds at this place. The coals are plainly marked on the hillsides by persistent benches, which cross the little ravines and pass from slope to slope, ascending gradually as they approach the mountain.

Turkey Foot (*Confluence*).

The geology at the Turkey Foot has already been broadly indicated, but it may again be stated that the Upper Freeport coal bed is below water level at this place, and that the confluence of the three streams occurs in the Lower Barren Measures. The *Rose bed* perhaps touches water level on reaching the town of Confluence, and possibly goes below the river before starting its ascent of Laurel Hill. High land overlooks Confluence from almost every side, and the great lack of coal that has always prevailed in the immediate vicinity of the town, has led to a partial development of the hills, the results being of a rather discouraging nature, the Barren Measure coals being thin and worthless. The following section, (Fig. 107, Page Plate XVI,) constructed by Mr. Charles A. Young, shows the contents of the hills at Confluence so far as at present known. The intervals between the coals do not entirely correspond with those of the Berlin section, but they agree closely enough to permit of an identification of the beds, as follows (Fig. 107):

Coal, Elk Lick bed.		
Interval	20′	0″
Limestone, Elk Lick ?	6	0 +
Concealed measures	67	0
Olive and black slate	8	0
Coal, Berlin bed	1	10
Concealed measures	10	0
Sandstone	20	0
Black slate	10	0
Coal, Platt bed ?	1	6
Concealed measures	95	0
Black slate	20	0
Coal, Price bed ?	1	8
Concealed measures and olive shales	110	0
Coal, Philson or Rose bed ?	3	0
Interval	15	0
Water level.		
Total	389′	0″

Passing south from Confluence, and ascending the Youghiogheny, little change is noted in the hills for a considerable distance. A rich crop of coal, showing in the road about two miles from Confluence, was thought to belong to the *Rose bed.*

Bohlen Mine.—Ascending the stream to a point within about three miles of Smithfield, the Freeport group is found above water level on Mr. John Bohlen's farm. Bed D was here opened and mined just above the river, which at high water seems to have interfered with the work, and the mine was abandoned. The following measurement was reported:

Black slate roof.			
Coal	1′	5″	2′ 7″
Slate	0	2	
Coal	1	0	
Fire clay.			

The Freeport sandstone here shows in the bank just above the mine, extending for 30 feet above the water, its outcrop being marked by a laurel thicket.

Bed E, or the Upper Freeport coal, makes its appearance at Mr. J. Bohlen's house, and measures, according to Mr. Bohlen, 3 feet thick, half of which is composed of good coal, and half of slaty, bony coal.

The Mahoning sandstone shows on the hill just above the coal. The outcrop of this sandrock covers the hill with huge boulders. The deposit is easily followed along the slopes; it is often conglomeritic, and outcrops in high, steep cliffs.

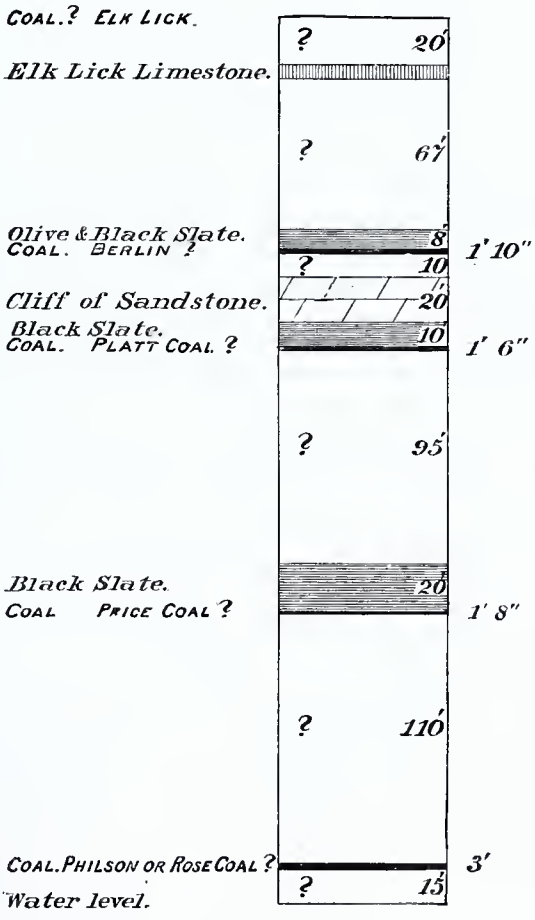
The hill rises several hundred feet higher, and includes near

SECOND GEOLOGICAL SURVEY OF PA.

1876

Fig. 107.

CONFLUENCE.



its top *the Elk Lick limestone*, which by barometrical measurement is here about 500 feet above bed D. This interval corresponds very closely with that obtained at Ursina. It is quarried on *Mr. Klein's land*, 8 feet of limestone having been exposed, overlaid at a short interval by about one foot of coal smut. The limestone is of a bluish cast, hard, compact, semi-crystalline, fossiliferous and has a slightly conchoidal fracture. The same limestone also appears on the opposite side of the river.

Smithfield.

At Smithfield, 3 miles north of the Maryland line, *bed D* and its *ferriferous limestone* are above water level on the Fayette county side of the river, and the coal is mined at several points in the vicinity of the last named town. The sharp south-east dip which prevails buries it at once under the river, and it cannot be mined by drift above water level at Smithfield on the Somerset county side of the Youghiogheny. A heavy massive sandstone, 20 feet high, rests almost directly over the coal, outcropping usually in vertical cliffs. This sandstone is easily recognized, and ranging with considerable persistency over large areas, furnishes a valuable and trustworthy guide to the whereabouts of coal bed D. It can be traced for several miles along the Youghiogheny river, keeping close to the water. At the western end of Smithfield its outcrop is plainly marked by a steep bluff at the abutment of the bridge.

Lenhart Mine.—Coal D is mined on Mrs. Lenhart's land in Fayette county. The bed is small and slaty, but of sufficient thickness to mine for domestic consumption, for which purpose it is largely used. A thick band of fire clay slate runs through the centre of the bed. The coal is moreover much reduced in thickness at Smithfield, as compared with its dimensions in the Castleman valley. Drifts have been opened on both sides of the National road, near Mrs. Lenhart's house, the bed showing as follows (Fig. 108):

Fig. 108.

Slate.		
Coal	1′ 0″	4′ 1″
Slate	0 1½	
Coal	0 2½	
Parting.		
Coal	thin.	
Parting, fire clay slate	1 2	
Coal, hard	1 7	
Impure fire clay.		

Search has never been made on this property for the ferriferous limestone, but the deposit is handsomely exposed on Mr. H. Heinbach's farm, one mile to the north. It was here opened a few feet above a small run, the limestone deposit showing about 4 feet of stone in two layers, a third layer, 2 feet thick, remaining uncovered. The stone is of a dark color, hard, compact and ferriferous, and requires hard burning to drive off the carbonic acid.

From 65 to 70 feet above the quarry *coal bed D'* was opened up 18″ thick; the bed shows well, being composed of bright shining coal, overlaid by 5 feet of tough black slate. Still higher on the same hill, which rises several hundred feet above the river, an outcrop of coal and black slates was observed. The coal was once partially opened and is reported to have been found to be two feet thick.

Above this the *Mahoning sandstone* shows in great abundance, covering the slope with blocks and boulders of sandstone. As already stated the same rock is observable for a considerable distance down the river; it is owing to the outcrop of this sandrock and similar formations higher in the Lower Barren Measures that a large part of the Youghiogheny valley still remains in an uncultivated state.

PART IV.

COMPARATIVE GEOLOGY

OF THE

FIRST BITUMINOUS COAL BASIN OF PENNSYLVANIA

IN CENTRE, CLEARFIELD, CAMBRIA AND SOMERSET,

WITH THE ALLEGHENY RIVER COUNTRY.

CHAPTER XVII.

A discussion of the principal vertical sections, obtained in the First Basin to determine the actual number and order of coal, limestone and iron ore beds which make up the series.

The surveys of 1874, 1875 and 1876, extending along the Allegheny Mountain from West Branch of the Susquehanna river to the Maryland State line, have resulted in establishing with a virtual completeness the following as the real number and order of coal beds, limestone beds, and dominant sandstone beds in that thickness of coal measures which has been spared in the general erosion of the country lying immediately west of the Allegheny Mountain.

In other words, the following list of 39 rocks may be safely accepted as embracing *all the well marked, persistent and wide spread beds of coal, limestone, ore and sandstone in the First Bituminous Coal Basin*, as opposed to local and variable deposits.

The intervals of clay, shale, shaly sandstone, sandy shale, ferruginous shale, ferruginous sandstone, "bastard limestone,"

carbonaceous shale, black slate, are therefore not mentioned in this list, although these make up most of the entire mass of the Coal Measures. They will however be mentioned, by character and by thickness, in the sections which follow on subsequent pages, from which sections of course this *general key list* has been constructed. But the object of this list is to give the provisional names, and show the now well established order of superposition of the coals, limestones, &c. which have proved themselves, in a perfectly good geological sense, universal deposits throughout the First Basin.

While other beds are local in their occurrence, these are only locally wanting, or have not been exposed, and may be searched for by the miner.

It is believed that there are no others left to be discovered; that the list is now complete; and that the discussion of its completeness in this chapter will be satisfactory to those who use this book as a geological manual for field work.

In the following chapter a special discussion will be made of the classical "Ferriferous Limestone" of the Allegheny River country, to show its absence as a key-rock from the Allegheny Mountain country, and the confusion which has been introduced into the geology of the latter by confounding it with a *ferriferous limestone* higher in the series, to which the name of the "Johnstown Cement bed" is now assigned.

1.	1. Uniontown coal, 2. Uniontown or Great limestone, 3. Sewickley coal, 4. Sewickley limestone, 5. Redstone coal, 6. Redstone limestone, 7. Pittsburg coal and its Rider,	Upper Productive Measures, 200 + feet.
2.	8. Lower Pittsburg coal, 9. Lower Pittsburg limestone, 10. MORGANTOWN SANDSTONE, 11. Elk Lick coal, 12. Elk Lick limestone, 13. Berlin coal, 14. Berlin limestone, 15. Platt coal, 16. Price coal, 17. Coleman coal, 18. Coleman limestone, 19. Philson (or Rose) coal, 20. Philson limestone, 21. Johnstown iron ore, 22. Gallitzin coal, 23. MAHONING SANDSTONE,	Lower Barren Measures, 550 to 600 feet.

3.	24. Coal E, Upper Freeport,	Lower Productive Measures, 300 + feet.
	25. Freeport limestone,	
	26. Coal D', Middle Freeport,	
	27. Middle Freeport limestone,	
	28. Coal D, Lower Freeport,	
	29. Johnstown Cement bed, or ferriferous,	
	30. Coal C,	
	31. Coal B',	
	32. Coal B,	
	33. Coal A',	
	34. Coal A,	
	35. PIEDMONT SANDSTONE,	XII.
	36. Coal, Mt. Savage,	
	37. POTTSVILLE CONGLOMERATE,	
	38. Mauch Chunk red shale,	XI.
	39. Mountain limestone,	

Upper Productive Coal Measures.

The Upper Productive Coal Measures are only found at one place in the First Great Basin. This is in the Salisbury Basin, in the southern part of Somerset county. It is bounded by the Castleman river on the north, by the Allegheny Mountain on the east, by the Maryland line on the south, and by the Negro Mountain on the West.

The Upper Productive Measures here occur in the central high plateau which lies along the synclinal axis of the basin enclosed between the Castleman river and Elk Lick creek. The central plateau covers an area 9 miles long by $1\frac{1}{2}$ to 2 miles broad: and this small area is the only patch of Upper Productive rocks in the whole of the First Great Basin from one end of the State to the other.

The Salisbury basin affords an excellent opportunity for making a vertical section of the Upper Productive Measures from the base of the Pittsburg coal bed to the sandstone overlying the Uniontown coal bed.

As to the naming of the coals and limestones of the Upper Productive Coal Measures, it must be remembered that some names are needed for convenience in discussion; but the whole nomenclature of the Upper Productive Measures is discussed by Prof. Stevenson in Reports K and KK, and those reports are authority upon the subject.

The compiled section reads as follows:

Hill top.				
Sandstone.....			40′	0′
Coal.....	*Uniontown Coal.*	.....	0	2
Parting		.....	0	$1\frac{1}{2}$
Coal.....		.....	1	10

Clay and dirt			1′ 6″
Limestone,	*Uniontown limestone*,	.....	1 6
Clay		.....	0 10
Limestone,		.....	10 0
Interval			45 0
Coal			1 0
Interval		8 to	10 0
Coal, Sewickley			2 0
Limestone, Sewickley Limestone			10 0
Interval			23 0
Sandstone			10 0
Interval			11 0
Coal.....	*Redstone coal.*	.....	0 2
Parting		.....	0 2½
Coal.....		.....	0 6
Parting		.....	0 1
Coal.....		.....	2 3
Clay			0 9
Black bituminous clay			0 2
Black slate, with nodular iron ore			3 0
Limestone and shale,	*Redstone limestone*,	.....	1 3
Impure fire clay.....		.....	1 10
Limestone.....		.....	10 0
Interval, slates			10 0
Coal (*Rider coal*) reported			3 0
Slate			4 0
Coal, Pittsburg bed			10 0
Total			215 2

In the above section the most striking feature is the great size and purity of the Pittsburg coal bed; for over a large part of the basin it exists in one solid bench of lustrous coal, without any partings save a small bearing-in slate about 18 inches above the floor.

The massive limestone under the Redstone coal has been called the Redstone limestone.*

It is interesting to note how the above section compares with sections of the same measures made in other basins.

*Mr. J. C. White states that at Morgantown, West Virginia, on the west bank of the Monongahela river, the Redstone coal is 40 feet above the Pittsburg coal; and that under the Redstone coal, separated from it only by a few feet of parting rock, there is a limestone 10 feet thick; that this limestone is uncertain, and that on following it down the Monongahela it is repeatedly seen to cut out entirely, and then as suddenly come in again.

Thus, in the Second Basin, that of the Ligonier Valley,* the section of the Upper Productive measures reads thus:

Highest land.			
Coal, bench.			
Interval		10′	0″
Limestone	7′ to	8	0
Fine bedded sandstone		35	0
Redstone Coal [wrongly called Sewickley]		3	0
Interval		5	0 (?)
Limestone [Redstone] good, hard, blue		8	0
Shales and black slates		10	0
Rider Coal [wrongly called Redstone]		3	0
Shales, brown and black slate		20	0
Pittsburg Coal Bed.			

The close correspondence of the above section with that made in the Salisbury Sub-Basin of the First Great Basin is very striking.

In Greene county,† in the south-east corner of the State, the following section represents the average of the Upper Productive Measures. Only a part of the section is here given, the part between the Uniontown and Pittsburg coal beds:

Uniontown coal bed	1′ to	3′	0′
Limestone and shale, Sandstone and shale, Limestone and shale, (Great Limestone.)		18	0
		60	0
		55	0
Sandy shale		40	0
Sewickley coal bed	1′ to	6	0
Sandstone		10	0
Limestone		18	0
Sandstone or sandy shale		25	0
Redstone coal bed	1′ to	4	0
Limestone		10	0
Pittsburg (Upper) sandstone		40	0
Shale	0′ to	10	0
Pittsburg coal bed.			

In the above section the Redstone coal and limestone and the Sewickley coal and limestone agree quite closely with their position in the section of the measures in the Salisbury sub-basin, but the interval distanee between the Sewiekley and Uniontown coal beds is inereased from 70′ to 170′.

*Final Report of 1858, Vol. II, page 661.

†Report K, 1875, page 59.

Lower Barren Measures.

The Lower Barren Measures scarcely show themselves in the First Great Basin where it runs through Centre and Clinton counties.

In Clearfield county (in the First Basin) the measures cover a limited area at the centre of the synclinal, and even then they only embrace a small part of the series. In the brief examination of Clearfield in 1874 but little attention was paid to them, and no single coal bed was ever seen opened in them. The Barren Measure rocks in Clearfield county, as in other localities, are usually brown, olive and gray slates and shales, easily disintegrated and showing few outcrops.

In Cambria county, however, the sub-basins take in along their centre, or synclinal axes, a large amount of Lower Barren Measures. Very small coal beds, one foot thick or perhaps a trifle more, are found in them.

The first case of a Barren Measure coal reaching workable size is at Brown's mine at Summerhill,* where a coal from 200 to 250 feet above the Upper Freeport Coal (probably the *Price bed* of the Berlin section) has been opened up for working. It illustrates very forcibly the treachery of the Barren Measure coals by its rapid changes in size and character, and the mine has been abandoned for that reason. The bed only covers a small area.

The next typical exhibition of the Barren Measure coals and limestones which it is desirable to note is given in Fig. 86, Page Plate XIII, p. 223 of this volume. It shows in detail the measures from the Elk Lick limestone (opened at Berkey's quarry) down to the Mahoning sandstone on the creek near Forwardstown.

The next typical section of Lower Barren Measure rocks, and one which is especially complete and valuable, is the section at Berlin, Somerset county. It is given in full and in detail on Page Plates III and V, and p. 23 of this volume.

The number and size of the coal beds in this section are particularly striking.

At the Turkey Foot (Confluence), in the southern corner of Somerset county, a tolerably complete section of the Lower

*Report HH., Cambria county, 1875, pp. 38, 39, 40.

Barren Measures, from the Elk Lick coal and limestone down to coal bed D of the Lower Productive series, has been compiled from numerous exposures. It is given on page 258 of this volume, and is figured as Fig. 98, Page Plate XIV.

These sections having all been given in full and illustrated, it is only necessary to refer to the descriptions without repeating the details.

The examination of the Lower Barren Measures in the First Basin has revealed some curious features.

It has long been known that the Lower Barrens possessed some small coal beds. These were usually only a few inches thick, and rarely exceeded one foot. Moreover, the soft rocks of the Barren Measures disintegrate so easily that the surface is covered deep with loose stuff and soil, and thus complete vertical sections are difficult to obtain. The imperfections of the sections naturally strengthened the prevalent opinion of the non-continuity of the coal beds, and they were frequently regarded as sporadic and almost valueless as geological horizons.

It is undoubtedly true that the normal condition of a Barren Measure coal bed is to be small, slaty, variable, and worthless for practical purposes. There seems to be no doubt that at the time of the deposition of these rocks there was a lack of the requisites for a regular and persistent coal bed; just as at the time of the deposition of the Lower Productive series there was every requisite for the production of regular, persistent and valuable coal beds. There is therefore just as much likelihood that a productive coal bed will become non-productive, as that a Barren Measure coal will become valuable.

We know how frequently over small areas a productive coal thins down, becomes troubled, pinches, has "wants," and in other ways ceases to be its usual self; and just so do we find the insignificant little beds of the Barren Measures suddenly swelling out and taking a size and shape to rival the Pittsburg Bed itself.

But in each case we look to see the normal condition of affairs quickly restored, and such restoration is usually speedy.

The developments of Barren Measure coals and limestones

in the Berlin and Salisbury sub-basin is probably more complete than at any other place in Pennsylvania, and the compiled list of coals and limestones is therefore reproduced. (See Page Plate VI and VII of this volume. It reads thus:

Pittsburg Coal Bed.

Interval		20′ 0″
Black slates		9′ 0″
Ferriferous shale and limestone		11′ 0″
Interval		14′ 0″
Coal, Little Pittsburg		2′ 0″
Limestone, Little Pittsburg		5′ 0″
Interval		17′ 0″
Coal, small.		
Slaty sandstone and iron ore		13′ 0″
Coal, small.		
Interval		13′ 0″
Slates		9′ 0″
Interval		10′ 0″
Sandstone		6′ 0″
Coal		1′ 0″
Slates		8′ 0″
Sandstone	Place for Morgantown Sandstone	18′ 0″
Olive shale		14′ 0″
Interval		8′ 0″
Sandstone		10′ 0″
Thin-bedded sandstone		5′ 0″
Interval		7′ 0″
Coal, Elk Lick bed		2′ to 4′ 9″
Interval		0′ to 25′ 0″
Limestone, Elk Lick		5′ to 10′ 0″
Interval		65′ to 70′ 0″
Coal, Berlin bed		3′ 8″
Interval		10′ 0″
Limestone, Berlin		8′ 0″
Slate and shale		5′ 0″
Coal and slate, Platt bed		7′ 0″
Interval		60′ 0″
Coal, Price bed		4′ 0″
Interval		60′ 0″
Coal, Coleman bed, (in one place 6′ thick,)		1′ 10″
Slate		0′ 6″
Limestone, Coleman		3′ 0″
Interval		40′ 0″
Coal, Philson bed (or Rose)		1′ 6″
Limestone, Philson		3′ 0″
Interval, (place of Johnstown iron ore near bottom)		40′ 0″

*Gallitzin coal**	1′	8″
Interval to Upper Freeport coal	60′	0″
Total	623′	3′

To the more important of these coal beds, and to the limestones, new names have been given, the old name of "Elk Lick Coal" being retained.

The singular error of the First Survey in assigning only about 200 feet as the thickness of the Lower Barren Measures in the First Basin naturally kept all identifications under a cloud so long as the original erroneous thickness was adhered to. The old Elk Lick coal opening was located as only 200 feet below the Pittsburg coal bed, and yet *just on top* of the Mahoning Sandstone, while it is in reality fully 300 feet above the top of the Mahoning Sandstone. As the latter was frequently used as the guide for the location of the bed the inevitable misidentifications became more and more numerous, until this bed became an absolute hindrance and obstacle to any correct nomenclature for the Barren Measure coals. It is believed that the above sections settle definitely its geological horizon.

The variability of the Barren Measure coals, both as to character and size, and also as to rapidity of change, has been discussed on p. 251 *et seq.* of this volume, in connection with the openings on the Philson (or Rose) coal bed on Brown's run, 3 miles from the Turkey Foot.

While this variability of the Barren Measure coals, in connection with their usual insignificance as to size, is sufficient to justify the utmost caution before making any plant to work them, yet the limestones accompanying the coals are not only much more persistent and regular than the coals beds, but over a large part of southern Somerset seem as persistent as any limestones of the Lower Productive Measures.

The Elk Lick limestone, for example, is of its full size and character at Berkey's quarry, near Forwardstown; at Berlin; in the Salisbury basin on Elk Lick Creek; and at the Turkey

*This coal is 5 feet thick at Brady's Bend, Armstrong county, on the Allegheny river; and it would better perhaps in making up the final nomenclature to call this the *Brady's Bend Coal*. It was described by Prof. Lesley many years ago at the latter place, but he then named the bed as *possibly* the Elk Lick Coal. Mr. White will probably describe this same bed in his Report on Lawrence County as the *Brush Creek coal bed* of that district.

Foot; these widely separated openings showing the persistence of the bed over the greater part of Somerset county wherever the hills are high enough to catch it, which only happens along the centre lines or synclinal axes of the basins.

If the Lower Barren Measures where they appear in other places had ever shown any such section of workable coals and limestones as is exhibited at Berlin, they would never have received the name they now bear; yet in face of the numerous coal and limestone Barren Measure beds of Somerset county the name is still eminently expressive of the system as a whole. The unsteadiness of the coal where opened in Somerset county is strongly confirmatory of the usually accepted idea that the measures are *practically* barren of marketable coal in comparison with the more regular Upper and Lower Productive coal series.

Yet the Berlin region of Somerset county may prove, on development, to possess very considerable areas where some one or more of the Barren Measure coals are of commercial value. If such places are carefully examined beforehand, the risks may be greatly reduced.

The limestones have been extensively and successfully worked, and will undoubtedly continue to be largely wrought for agricultural purposes.

For the general character of the soft gray, olive, reddish and brown shales which make up the interval rocks of the Lower Barren Measures there is nothing necessary to add to the details already given. They resemble the same rocks in other basins in appearance, thickness and constituents.

That these Lower Barren Measures keep their general character over broad areas is evidenced by the following section of the same measures in Beaver county,* which is reproduced for convenience of comparison:

Pittsburg coal bed	8′ 0″
Shale	8 0
Limestone	5 0
Concealed	100 0
Shale	10 0
Coal	1 6
Sandy shale	35 0
Limestone	4 0

*Report K, 1875, page 334.

Calcareous shale, fossiliferous		3	6″
Slaty *coal*		1	0
Shale		10	0
MORGANTOWN SANDSTONE	60′ to	70	0
Shaly sandstone	35 to	50	0
Coal	0 to	3	0
Flaggy sandstone	25 to	35	0
Crinoidal limestone	2 to	5	0
Coal		1	4
Variegated shale	25 to	30	0
Bluish sandy shale	50 to	60	0
Red clay shale	0 to	20	9
Cannel coal, local	6		
Laminated sandstone	90 to	100	0
Limestone or calcareous shale, black	0 to	5	0
Dark shale	0 to	15	0
Coal	0 to	2	6
Sandy shale	25 to	35	0
MAHONING SANDSTONE	30 to	70	0
Shale	0 to	12	0

Upper Freeport coal bed.

In spite of the broad area intervening between Somerset and Beaver counties, and in spite also of the usual incompleteness of Barren Measure sections, yet this section shows that the same coals and limestones of the Lower Barren Measures in the First Basin are found in Beaver county, north of the Ohio river

In the extreme south-east corner of Greene county* the Barren Measures directly under the Pittsburg coal bed show thus:

Pittsburg coal bed.

Clay	4′	0″
Calcareous shale	5	0
Sandstone and shale	30	0
Coal bed	1	6
Limestone	12	0
Shale	25	0
Sandstone	35	0
Arenaceous shale	15	0
Coal and clay	0	11
Limestone and shale	11	10
Sandstone	10	0
Shale	4	0

In this, as in almost all vertical sections of the measures directly underlying the Pittsburg coal, there is either a limestone, or at least calcareous clay to represent the horizon. But in the First Basin, there is not yet observed any limestone or

*Report K, 1875, page 76.

calcareous clay under the floor of the Pittsburg coal at any point. The first limestone below it is the limestone underlying the Little Pittsburg coal bed, 50 feet below the Pittsburg coal bed.

In the Second Basin (the Ligonier Valley) the Final Report of the First Survey* gives the measures under the Pittsburg coal thus:

Pittsburg coal.		
Interval		20′ 0″
Pittsburg limestone, white, flaggy, good	4′ to	9 0
Flaggy sandstone, etc		20 0
Coal, good		3 0
Interval		8 0
Limestone, ferruginous		3 0
Shales, olive and black		15 0
Coal, outcrop		.. ..
Sandstone [wrongly called Mahoning]		50 0
Olive shales		24 0
Black slate		6 0
Coal, outcrop		.. ..
Interval		15 0
Coal, outcrop [Elk Lick]		.. ..
Olive ferriferous shale		30 0
Coal [wrongly called Upper Freeport]		1
Limestone [wrongly called Freeport] (Elk Lick)		1

The limestone at the bottom of the section is the Elk Lick Limestone, and the coal crop, 30 feet above, represents the Elk Lick Coal. The whole section corresponds closely with that showing itself in the First Basin.

Lower Productive Measures.

The Lower Productive Measures stretch through, across and under the First Basin almost continuously from the Susquehanna river to the Maryland line.

At the north-east, between the Susquehanna and the Moshannon, the coals lie in the detached basins of the Tangascootac, Beech Creek and the Snow Shoe basin. But beyond the Moshannon they become continuous, reaching from the Allegheny Mountain to Laurel Hill, save where they may have been eroded from the tops of the anticlinal sub-axes, or buried beneath the Lower Barren or Upper Productive Measures. Where these latter events occur has already been told in the

*Report of 1858, Vol. II, page 661.

detailed report. The typical compiled section of the Lower Productive Coal Measures shows these coals and limestones:

Coal, bed E, Upper Freeport..... averaging,	4′	0″
Limestone, Freeport, usually present, but frequently wanting.		
Interval.....	60′	0″
Coal, bed D′, Middle Freeport ..... averaging,	2′	6″
Limestone, Middle Freeport, usually wanting, but frequently present.		
Interval.....	40′	0″
Coal, bed D, Lower Freeport..... averaging,	3′	0″
Johnstown Cement bed, almost universally present in the southern end of the basin, in Somerset and part of Cambria county, but lacking to the northeast in Clearfield and Centre counties.		
Interval.....	50′	0″
Coal, bed C..... averaging,	1′	6″
Interval.....	30′	0′
Coal, Bed B′..... averaging,	1′	0″
Interval.....	20′	0″
Coal, bed B.....	4′	0″
Interval.....	25′	0″
Coal, bed A′..... averaging,	1′	0″
Interval.....	20′	0″
Coal, bed A..... averaging,	4′	0″
Piedmont Sandstone..... } XII. { ..... 50′ to	75′	0″
Coal, Mt. Savage bed..... } XII. {	2·	0″
Pottsville Conglomerate.... } XII. {	150′	0″+

This may be taken as a typical average specimen of the vertical section yielded by the Lower Productive Measures in the First Basin, and with which, as well as with each other, all other sections to be given can be compared.

The First Basin on the Susquehanna.

The coals and fire-clay of the First Basin have been developed on the north side of the Susquehanna river at Queen's Run and Farrandsville, in Clinton county.

Only the two lowest coals of the Lower Productive Measures are included in the measures at these places, and they are only caught on the hill-tops.

The interval distances correspond quite closely with the average section as given.

Though this discussion relates chiefly to interval distances between the beds at different places, yet there are two points of marked interest in the First Basin on the Susquehanna. These are:

1. The great size and purity of the fire-clay deposit. It has been largely worked, and is widely known from the high character of the bricks and tiles produced from it.

2. Only a small area is covered by the upper of these coal beds. The coal was tested by Prof. Johnson in the tests for the Navy Department, and it stood among the first for calorific efficiency.

Tangascootac Creek.

The coals of the First Basin have been opened and worked in the past on the banks of Tangascootac creek, on the south side of the Susquehanna river.

The two or three lowest beds of the Lower Productive system are the only ones caught in the hills of this shallow basin.

Neither the fire-clay nor the coals have the same size and excellence of character as the coal and clay at Queen's Run and Farrandsville, just across the Susquehanna river

The intervals between the coals and the Conglomerate correspond closely with the average section.

Beech Creek.

The imperfect exposures on Beech Creek show that Beds A and B, and perhaps D on the highest detached hill tops, are certainly in the basin along its central synclinal axis. The interval distances correspond closely to those at the Tangascootac to the north-east, and at the Snow Shoe to the south-west.

These small basins along Beech creek are apparently detached, the Conglomerate of XII making the country rock, and the Lower Productive coals coming into separate hills.

The Snow Shoe Basin.

To the south-west of Beech Creek, in Centre county, lies the larger, but also detached, Snow Shoe Basin.

The measures are well opened up here for extensive shipment to market, and the full vertical section of the Lower Productive Measures is as follows:*

Surface and cover	25′ 0″
Coal, E, Upper Freeport	5 0
Fire-clay	5 0

*Report H., 1874, p. 69.

Concealed measures	41′	9″
Sandrock	7	0
Coal, D,' Middle Freeport	2	0
Brown ore and coal	2	0
Hard Limestone	2	6
Light colored clay	5	0
Black slate	34	4
Slaty Cannel	2	0
Coal D, Lower Freeport	5	8
Fire-clay	3	0
Slates, light colored	16	6
Light colored sandstone	13	0
Coal and slate, "Slaty Coal," C	4	0
Black slate	11	6
Grey sandstone	17	0
Black slate	10	0
Coal, bony	1	0
Coal, B	4	0
Concealed Measures	45	0
Iron ore	4	0
Gray sandy slate	14	0
Coal A	3	0
Total	283′	0″

The salient features of this vertical section, some of which will be discussed further on, are:

1. That the interval distances between the coals agree almost exactly with the typical section, the latter having been compiled from vertical sections made at widely separated places, such as Bennington, Johnstown, Osceola and Snow Shoe.

2. That the Freeport limestone, under the Upper Freeport coal, is wanting, and that the Lower Freeport limestone, or Johnstown cement bed, under bed D, is also wanting.

3. That the Middle Freeport limestone, which is usually wanting in the First Basin, is present in the Snow Shoe section.

4. That between beds A and B there is a carbonate of lime and iron. This is of especial importance as bearing upon the question of Ferriferous Limestone identification, and also because at other points in the First Basin a valuable bed of iron ore has been found at this horizon, (notably at Hooversville, in Somerset county) and the identification at Snow Shoe is proof of a widespread evenness of deposit for the bed.

The Snow Shoe coals are large, quite pure, and make a very valuable and efficient steam coal.

The Moshannon Coals.

The coals of the First Basin are opened and very extensively shipped to market from the mines on the banks of the Moshannon creek and the Beaver Branch, in Clearfield county.

The section showing along the Moshannon, at Osceola, reads thus:*

Surface.		
Sandstone	15′	0″
Slates	15	0
Sandstone and shales	30	0
Coal bench (D′ ?).		
Shales	45	0
Coal D 3′ 6″ to	5	8
Fire clay, Sandstone, thin, and shales	30	0
Shales	30	0
Coal C 1′ 6″ to	2	0
Shales	45	0
Coal B 4′ 0″ to	5	0
Slates and shales	20	0
Sandstone	40	0
Slate	6	0
Coal A	4	6
Fire clay at creek level.		
Total	293	2

The interval distances as given above show a close resemblance to the typical section. The striking points are:

1. The total absence of any limestone from the section.

2. The disappearance of the iron ore and limestone between beds A and B.

At this place, as at Snow Shoe, Tangascootac, and on Queen's run, coal bed A is loaded with iron pyrites, and cannot be worked.

But beds B and D, on the Moshannon and the Beaver Branch, are large beds of lustrous coal, almost without slate partings, usually free from horsebacks and troubles, and yielding coal of such high calorific power as to take equal rank with the Cumberland steam coal.

The large bed on the Beaver Branch was with hesitation identified as bed B. It would have been identified as bed D, from its size, structure of coal, roof and floor, and general character and composition, had it not been for the following

* Report H, 1874, page 23.

section, made at the north side of Beaver creek, at the Moshannon colliery. The section reads thus*:

Surface.		
Sandstone	20′	0″
Coal and fire clay underlying.		
Slates	44	0
Coal	5	8
Fire clay.		
Slates and shales	25	0
Coal, reported to be	2	9
Slates and shales	30	0
Coal, reported to be	2	8
Interval, slates chiefly	46	0
Coal	2	6
Parting	0	6
Coal	1	0
Fire clay	5	0
Level of creek.		
Total	185	1

If the bed just above water level on the above section (which is the large bed of the Beaver Branch and is worked at a somewhat higher level by the Moshannon Colliery on the south side of the stream) be identified as Bed B, then, the section shows beds B, C, D, (the large bed, 5′ 8″) and D′ all in place, and with their proper interval rocks.

Whereas if the Moshannon bed be identified as Bed D, then the section shows *two beds* between D and E (taking the 5′ 8″ bed to be E); a state of affairs shown in no other section in all the descriptions of the measures of the First Basin.

For this reason therefore, and in spite of many physical characteristics of the bed in which it resembled bed D, the bed was identified as bed B.

The rapid survey of Clearfield and Jefferson county was especially directed to the practical examination of the regions then so rapidly growing into importance, with a view to publish as soon as possible a report upon their availability as gas and steam coals. Otherwise this question would have been more closely examined into at the time and definitely settled.

Clearfield Creek Above Glen Hope.

In the second or western sub-basin of the First Basin, the measures afford a partial section on Clearfield Creek above

* Report H, 1874, page 26.

Glen Hope, in Clearfield county. The section as measured at Leightner's shows*:

Hill top.		
Shales	15′	
Lean hematite iron ore in shales.		
Bench small, [D′].		
Shales	70	
Coal,[D] "called"	3	
Limestone crop, sandy and poor.		
Gray slates	38	
Coal, [C].		
Thin sandstones and shales	46	
Coal and fire clay partings, [B] called in all	9	
Brown shales	12	
Iron ore, carbonate, in layers, called	3	
Shales	15	
Sandstone	15	
Slate	5	
Coal, [A] called	5	
Fire clay	8	0′
Sandstone, massive	12	
Level of Clearfield Creek.		
Total	256′	0″

Identifying the lowest coal bed as bed A, the section gives beds B, D, and D′: the intervals separating the beds differing somewhat from those of the typical section, and the section on the Moshannon in the first sub-basin.

An important feature is the presence of a limestone under bed D; this must be considered its first appearance in the First Basin in the region between Clearfield Creek and the Susquehanna river.

Clearfield Creek at Madera.

A vertical section made at Madera, on Clearfield Creek, in the second or western sub-basins of the First Basin shows as follows†:

Hill top.		
Shales	20′	0″
Small bench and coal smut.		
Shales and unknown	55	0
Bench, reported 6′ coal, [E].		
Thin sandstones and slates	40	

*Report H, 1874, page 107.

†Report H, 1874, page 103.

Bench, not opened, [D'].		
Shales, buff and brown, with a little lean hematite ore in small pieces	31'	0''
Fire clay, not opened, reported	9	
Black slate	5	
Coal, not opened, [D] called	5	
Shales and slates	41	
Slates, hard and dark colored, with nodular carbonate iron ore	9	
Black slate	5	
Coal, not open, [C] *called,*	4	
Sandstone	26	
Coal, [B] *called,*	4	
Sandstone	30	
Level of Clearfield Creek, *coal reported in creek bed.*		
Total	284'	0''

A boring thus supplements the section.

Creek level	0	
Micaceous sandstone at	33'	
Hard, white, flinty SS., [Piedmont ?], at	48	
Pieces of bituminous coal [Mt. Savage] in brownish conglomerate SS., [XII ?] at	110	

This section, in conjunction with the section at Leightner's, serves to show that the Lower Productive system is running with great regularity through both the first and second sub-basins in the southern portion of Clearfield county.

Though these sections are made at widely separated points, and only barometrically leveled, yet the identifications are perfectly simple, and it is clear that between the Susquehanna river and the Moshannon and Clearfield creeks the Lower Productive system preserves the parallelism of its included coal beds with great regularity.

Clearfield Creek, near Fallen Timber.

A vertical section of the measures exposed on Clearfield creek, near Fallen Timber, Clearfield county, in the first, or eastern, sub-basin of the First Basin, shows as follows*:

Hill top.		
Bench (?).		
Interval, thin broken SS. on surface	40'	0''
Bench, bed E?		
Interval	60	0
Bench, bed D' ?		
Interval	60	0

*Report HH, 1875, page 81.

Bench, black slates, bed D?		
Interval	80	0″
Coal, bed B	4	0
Fire-clay.		
Sandstone and sandy shales	20	0
Sandstone, fine-grained	20	0
Coal, bed A	2	6
Interval	20	0
Clearfield creek.		
Total	306	6

The section, though incomplete in expressing only partially the character of the coals and interval rocks, yet shows clearly that as far south as Fallen Timber the Lower Productive system is not different from where it is exposed in Clearfield and Centre counties.

Bennington, Blair County.

A very complete section of the measures at Bennington Station, on the Pennsylvania railroad, near the Blair and Cambria boundary line, has been compiled from outcrop exposures and shaft records. It shows in detail the coals, and the character and thickness of the interval rocks, as follows: *

Mahoning sandstone	?	
Coal bed	2′	8″
Drab shales	20	0
Olive shales	5	0
Massive slates	10	0
Olive slates and shales	20	0
Coal, bed E	5	6
Fire-clay, impure	2	0
Sandstones and black slates	20	0
Limestone	3	0
Ferruginous slates and shales	20	0
Sandstones and sandy shales	20	0
Coal, bed D′	3	0
Fire-clay	1	0
Sandstone, drab	21	0
Black slates	20	0
Coal, bed D	2	10
Drab slates, holding iron ore balls	11	0
Sandstones	0	7
Blue slates	13	0
Sandstones, massive drab	15	0
Slates	12	6
Coal..	0	6
Slate.. *Bed C.*	0	6
Coal..	1	8

*Report HH, 1875, page 3.

Fire-clay, impure	6′	0″
Sandstone	12	0
Slate	1	3
Coal	0	4
Sandstone	7	0
Black slates, with calamites	8	10
Coal, bed B	3	6
Fire-clay, good	3	0
Shales	29	0
Black slates	2	0
Coal, bed A′	1	8
Slates	23	0
Sandstone, gray	4	0
Coal, bed A	4	0
Fire clay	5	0
Sandstone, massive, gray	20	0
Gray and brown shales	10	0
Sandstone, massive	16	0
Black slates	1	8
Coal bed	1	8
Fire-clay	5	6
Conglomerate, massive, drab	15	0
Red shales and bog ore	10	0
Conglomerate XII	100	0
Total	512	2

The above section, made on the Allegheny mountain, shows interval distances between the coals almost identical with the section made at Snow Shoe, far to the north-east, and close to the Allegheny mountain crest.

But there are curious differences in the character of the interval rocks.

1. The Freeport limestone, underlying the Upper Freeport coal, is present at Bennington, though separated from the coal above by an unusually great thickness of interval rocks.

2. This limestone is entirely wanting at Snow Shoe, and in all the sections between Bennington and Snow Shoe.

3. Whereas the limestone under bed D′, which is two feet thick at Snow Shoe, is wanting at Bennington.

4. And both at Bennington and at Snow Shoe there is no limestone at all under bed D.

5. The iron ore deposit between coal beds A and B makes no appearance in the Bennington section.

Moreover, the Bennington coal from bed B is of unusual value as a coking coal. It is coked in open pits at the mine

mouth, and under a series of tests proved itself second only to Connellsville coke, and running a very little behind the latter.

The Bennington section, with very slight local changes, is found repeated to the north-east and south-west along the Allegheny Mountain, and also to the north-west at numerous points in the First Basin in Cambria county.

Ben's Creek, Cambria County.

Thus, at Ben's creek, an affluent of the Conemaugh river, and which enters it about midway between Lilly's and Portage Stations on the P. RR., the following complete vertical section is compiled*:

Black slate	3′	0″
Coal, bed E	4	4
Fire-clay	6	0
Black slates and shales	15	0
Limestone	7	0
Interval (?)	15	0
Sandstone	12	0
Coal	0	2
Sandstone	2	0
Fire-clay shale	6	0
Coal, bed D′	2	0
Fire-clay	2	0
Limestone (?)	2	6
Shales, ferriferous	15	0
Coal smut	0	2
Fire-clay shales, with balls of rough ore	5	0
Coal smut	0	3
Fire-clay	1	0
Slates and shales	6	0
Black slates	7	0
Coal, bed D	2	6
Fire-clay	1	6
Drab shales	25	0
Sandstone, fine-grained	30	0
Black slate	0	3
Coal, slaty and poor, bed C	2	0
Fire-clay	—	—
Sandstone	5	0
Fire-clay shale	10	0
Black slate	5	0
Coal, bed B′ ..... from 2′ 0″ to	4	0
Sandstone and shale	18	0
Coal, bed B	5	0
Fire-clay	5	0
Sandstone	0	10

*Report HH, 1875, p. 48.

Dove-colored shale, with ore	10′	0″
Sandstone	3	0
Fire-clay shale	2	0
Fire-clay		?
Interval	25	6
Coal, bed A (?)		
Total	265′	6

The section shows the interval distances just about as at Bennington.

The Freeport limestone is present, but separated from the Upper Freeport coal above by a large interval, as at Bennington.

The Middle Freeport limestone, under coal bed D′, is present at Ben's creek, (as at Snow Shoe,) while it was wanting at Bennington.

There is no limestone at Ben's creek under bed D, and it should be remembered that there is no limestone under bed D either at Bennington, on the Moshannon, or at Snow Shoe.

The sudden thickening and almost equally rapid thinning down of coal bed B′, about 20 feet above bed B, is a noteworthy feature of Ben's creek geology.

Bed B, the great coking coal at Bennington, yields on Ben's creek a superb fuel, highly valuable for steam purposes and for coking.

Johnstown, Cambria County.

The extensive operations of the Cambria Iron Company at Johnstown afford an excellent opportunity to secure a complete section of the Lower Productive Measures.

Johnstown lies in the second or western (Johnstown-Confluence) sub-basin of the First Great Basin

The section, as constructed by John Fulton, Esq., reads as follows:

Prosser's Knob.		
Stone quarry; sandstone	20′	9″
Olive shales	17	0
Drab shales	18	0
Thin bedded sandstone	10	0
Shales	8	0
Silicious iron ore	3	0
Olive and drab shales	68	0
Red shales	10	0

*Report HH., 1875, pages 97 and 98.

Olive shales	12′	0″
Slate and sandstone	10	0
White sandstone	26	0
Drab shales	13	0
Massive drab sandstone, forming cliff	20	0
Coal [Philson bed]	0	3
Drab colored shale	4	0
Drab sandstone	7	0
Slates	2	0
Johnstown iron ore seam	2	0
Flesh and drab-colored shales,	13	0
Iron stained shales	9	0
Iron ore	0	10
Fire clay	2	0
Soft drab shales	8	0
Fire clay and shales	4	0
Drab shales and sandstone ...	15	0
Place of the Mahoning Sandstone.		
Coal, bed E	3	0
Fire clay	1	0
Shales	5	0
Sandstone	10	0
Shales	5	0
Kidney iron ore	0	10
Shales	15	0
Sandstone	15	0
Shales	3	0
Coal, bed D	2	6
Shale, fire clay?	0	6
Limestone, brown, impure	3	0
Iron stained shales	17	0
Micaceous gray sandstone	21	0
Slates	4	0
Coal, bed D	3	6
Fire clay	0	9
Ferriferous limestone [Johnstown cement bed]	5	0
Fire clay, impure	7	0
Slates, with iron ore	8	0
Slate	8	0
Black slates, with iron ore	11	0
Coal 0′ 3″		
Slate 1′ 0″	1	6
Coal 0′ 3″		
Thin black slates	13	0
Coal, bed C (?)	0	9
Fire clay	4	0
Gray sandstone	13	0
Wavy sandstone, gray	4	0
Iron stained slates	6	0
Coal, bed B	3	6
Fire clay	3	0
Gray slates and shales	21	0
Massive black shales	15	0

Gray sandstone				5′ 0′
Massive black slate				5 0
Coal				thin.
Black slates				1 0
Gray sandstone				4 0
Thin gray slates				6 0
Coal, bed A	Coal	4′ 6″		6 10
	Slate	0′ 6″		
	Coal	1′ 10″		
Fire clay				3 0
Gray slates				28 0
White massive sandstone				15 0
Drab and black slates				10 0
Coal				0 2
Black slate				1 2
Drab fire clay				4 0
Olive colored shales				3 0
Plates of carbonate iron ore				1 0
Gray sandstone.				
Total				629 1

The above vertical section shows how very well the interval distances retain their regularity. There are scarcely any differences in measurement to be noted between the section at Bennington, on the east side of the First sub-basin; at Ben's creek, near the centre of the First sub-basin; and at Johnstown, near the centre or synclinal axis of the Second sub-basin of the First Great Basin.

But while the interval distances remain about the same, the character of the interval rocks in all these cases shows variations. In the Johnstown section:

1. The *Johnstown iron ore seam*, lying just on top of the Mahoning sandstone, is at Johnstown a regular and persistent deposit, of good character, which has yielded a large amount of iron ore to the Cambria Iron Company.

At this same horizon there are at numerous places in the First Great Basin ferruginous slates or iron ore balls; but in no other case is an iron ore deposit at this horizon extensively worked for furnace use in Pennsylvania.*

2. The Freeport limestone, under the Upper Freeport coal, is entirely wanting.

3. The Middle Freeport limestone under bed D′ or the "Limestone seam," is present at Johnstown.

*It is probably represented on Broad Top, in Huntingdon county, by the iron shales lying upon the "Top Rock" of Shoup's Run.

4. The *Johnstown cement bed*, or ferriferous limestone, is present, directly underlying coal bed D, or the Lower Freeport coal, as it has been called through these reports.* The presence of this bed is an extremely interesting feature of the section.

5. Coal bed B of the section has fallen off at Johnstown from the high coking character of the same bed displayed at Bennington, and does not show under analysis such purity as is evidenced by bed B on Ben's Creek.

It will be noticed that there is a small coal bed occurring above the *Johnstown iron ore seam;* this is probably the *Philson (or Rose) bed* of the Lower Barren Measures. That no other coals are shown for the 230 feet of Barren Measures exposed above this coal, is probably due to imperfect exposures and the consequent covering up of the small outcrops, rather than to a total absence of the Barren Measure coals.

Red Bridge, Stony Creek, South Cambria County.

The following vertical section† made near the Red Bridge over Stony Creek, near the south border of Cambria county, shows the interval distances between the coal beds thus:

Sandstone, massive	60′	0″
Coal terrace?		
Sandstone, thin bedded	45	0
Coal terrace?		
No exposures for	150	0
Coal slates.		
Sandstone, massive	36	0
Olive shales	6	0
Dark blue shale	4	0
Sandstone, with balls of iron ore	25	0
Dark shale	3	0
Slates, with iron ore nodules	1	0
Coal D′?.		
Limestone, hard	2	6
Fire clay	2	6
Olive shales	4	0
Coarse gray heavy sandstone	25	0
Black slates	6	0
Coal, bed D, (Lower Freeport)	5	0
Shale	0	3
Limestone, ferriferous	8	0
Blue black shale, with thin bands of SS	7	0
Black slates	0	10
Coal	0	6

† Report HH, 1875, page 126.

* Upper Kittanning of the West.

Black slates, with nodules of iron ore	6′	6″
Sandstone, massive, to bed of creek	7	0
Total	405′	1″

The section shows that both the Middle Freeport Limestone under coal bed D′, and the cement bed or ferriferous limestone under bed D, are present and of full size.

The interval distances correspond with reasonable closeness to the typical section of the First Basin.

Hooversville, Somerset County.

In a vertical section made at Hooversville, in Somerset county, given in detail on pp. 122–123 of this volume, the interval distances between the coals show such moderate variations from the typical section as may easily be accounted for either by thickening or thinning of the interval rocks or by barometrical errors.

The presence of carbonate of iron and lime between coal beds A and B, and 235 *feet below coal bed E*, is very noteworthy on the Hooversville section. It is of importance in the discussion of the identification of the Ferriferous Limestone (of the Allegheny river) in the First Basin.

Mineral Point, Castleman River.

A vertical section made at Mineral Point, on the Castleman river, in the Somerset sub-basin of the First Great Basin, and which is given in detail on page 192 of this volume, shows the interval distances but little changed.

The Middle Freeport limestone, under coal bed D′, and the Johnstown cement bed, or ferriferous limestone, under coal bed D, are both present, of the usual size and character.

Fort Hill, Castleman River.

A vertical section made at Fort Hill, in the south-west corner of Somerset county, on the Castleman river, given in detail on page 263 of this volume, shows the coals and the intervals. There is no special change or disagreement with the typical section.

The Philson (or Rose) coal bed of the Lower Barren Measures, 100 feet above bed E, and often mistaken for it, appears in the Fort Hill section at its proper horizon, and only 9 inches thick.

Laurel Hill Creek.

A section made at Faidleys, on Laurel Hill Creek, (see page 246 of this volume for details), exhibits the interval distances about as before given.

The Johnstown cement bed, under coal bed D, is present all along Laurel Hill Creek.

The section at Faidleys shows a limestone, overlaid by a conglomerate of rounded fragments of carbonate iron ore held together by silica. This limestone is about 210 *feet below coal bed E.*

This again is of noteworthy importance in the discussion of the presence in the First Basin of a representative of the Allegheny river Ferriferous Limestone.

Regularity of the Lower Productive Measures.

The sections given above have been selected in part from the great number already published in Reports H and HH, while many of those quoted are first published in this present volume.

The conclusion to be drawn from them is irresistible. Widely separated as the sections are in geographical position, ranging from the waters of Queen's Run and the Tangascootac, on the Susquehanna river, to the waters of the Castleman, on the Maryland line, there runs through them all a harmony and consistency that is in the highest degree convincing as to the parallelism of the Lower Productive Coal Measures in the First Basin.

And the sections show also that anticlinal sub-axes in no way affect this parallelism.

So true is this that in almost any part of southern Cambria or in Somerset county, if the coal bed D and its underlying Johnstown cement bed be identified, 40 feet above will be found D′, 60 feet higher bed E, and 100 feet higher (in the Barren Measures) the Philson (or Rose) coal bed.

Or starting downwards from coal bed D and its cement bed, beds C, B′, B and A can be located closely; and in no case is there any wide variation from the average.

It is true the interval between beds A and B varies from 50 to 70 feet at times, and that the other intervals are not abso-

lutely constant; but the variations are within such moderate limits that they can mislead no one who has correctly oriented himself as to his geological position in the measures.

But while all this regularity and persistency is true of the interval *distances*, it must not be imagined that the interval *rocks* maintain any such unvarying character, or that the coal beds themselves do not show great occasional inconsistencies.

These reports have furnished many instances where good productive beds have been necessarily abandoned over certain areas on account of their wretched character and small size; where small and insignificant beds are mined as large and pure coal beds over a limited region; where the rider or roof coal will range from the roof of the bed to 12 or 15 feet above it; and how after these changes the beds revert to their ordinary average condition.

Moreover, the reports show the gradual persistent changes which occur in coal beds. Coal bed D is a striking case. North of the Conemaugh the bed is only about $2\frac{3}{4}$ feet thick, always in one solid bench; and so it remains as far south as the Cambria county southern border line. South of Hooversville, in Somerset county the bed becomes parted by a thin slate layer; this layer thickens steadily, the benches of coal remaining for some time of full or increased size; and finally near the Maryland line the parting has gained at the expense of the coal benches and bed D shows two 1-foot layers of coal, separated by a 5-foot parting of slate. During all these changes the mineralogical character of the coal and its cuboidal structure remain unchanged.

The limestones vary more than the coals; for while the sections show them to be persistent over large areas, they show likewise that they are totally wanting at irregular intervals in the Cambria and Somerset part of the First Basin.

And they show, moreover, that of all the limestones of the Lower Productive system only the Middle Freeport limestone under coal bed D′ is found in Centre and in Clearfield counties in the First Basin.

The iron ores show a variability vastly greater than the limestones; a variability so great as to make instability their normal characteristic.

Many of the interval rocks are also seen to be very persistent. The Mahoning Sandstone overlying coal bed E, the Freeport Sandstone, the sandstone between coal beds A and B, the fire-clay underlying coal bed A, and the Piedmont Sandstone, are regular and recognizable. But even these regular rocks change their character totally at times.

Character of the Coals of the First Basin.

In general character the coals of the First Basin show a percentage of volatile matters varying from 18 to 26 per cent., and are therefore bituminous coals.

The Clearfield steam coals hold about 21 to 23 per cent. of volatile matters. The superior quality of these coals for purposes of steam generating or iron working, is widely known and their reputation is firmly established.

The Pittsburg coal bed, in the Salisbury basin in Somerset county, yields an average of 20 per cent of hydro-carbons; and the steam coal of Clearfield county furnishes about the same analysis.

Bed B, on the Allegheny Mountain, gives 26 per cent of volatile matters; on Trout run, in the centre of the first sub-basin only 18½ per cent of volatile matters; and at Johnstown only 16½ per cent of volatile matters.

All the analyses, from all the different beds, keep comparatively close to each other in general character, though of course varying widely in sulphur, ash, &c., and they all rank as bituminous coals.

CHAPTER XVIII.

Comparison of the Lower Productive Coals as a group and the ferriferous limestone of the First Basin with the Lower Coals and "Ferriferous Limestone" of the Allegheny River.

In the Reports on Centre, Clearfield, Cambria and Somerset counties*, the Freeport group of coals is always represented as triple, being made up of coal beds D, D′ and E.

On the Allegheny river, where the Freeport group was named by the First Survey, there are two Freeport coal beds, upper and lower; the interval between them being 80 feet, varying only slightly from this as an average; and both of them are workable beds.

The Freeport Limestone underlies, and the Mahoning Sandstone overlies the Upper Freeport coal, and a well marked Freeport Sandstone underlies the Lower Freeport coal.

No *closely* continuous geographical identification has ever been made of the coals on the Allegheny river with the coals on the Allegheny Mountain.

In 1874, during the examination of Centre and Clearfield counties, the following problem presented itself:—

If the Mahoning Sandstone be in place and clearly recognizable, and the Upper Freeport Coal bed (E) directly underlying it, 4 to 5 feet thick, but without any underlying Freeport Limestone; if sixty feet below E, a coal bed, 2 feet thick, with an underlying 2 foot limestone, has been opened and proved as a persistent bed; and if 40 feet below this again be a large, good, workable coal bed; may it be assumed that the two workable coal beds 100 feet apart represent the Lower and Upper Freeport coals of the Allegheny river? The answer was in the affirmative, and the small bed between them was named Middle Freeport, or D′.

*Report H, 1874; HH, 1875; HHH, 1876.

The Ferriferous Limestone much lower down in the series was, however, entirely wanting.

This grouping of the Freeport Coal System was adopted for the Reports of Progress of 1874, 1875 and 1876; and all the sections of these volumes are consistent with each other in being grouped on this plan. But as the examination of the basin was continued southward many doubts suggested themselves as to the propriety of this grouping.

The Freeport Limestone came in in Cambria county and took its regular place under the Upper Freeport coal (E).

The Freeport Sandstone also became marked and massive, and took its place under coal bed D′.

And a *new limestone,* the Johnstown Cement bed, became a regular and persistent layer under bed D.

After a comparison of the numerous sections of the First Basin with the sections of the Allegheny river it became evident that the *triple form* of the Freeport Group could only be maintained by sacrificing the whole system as adopted on the Allegheny river; and as this latter system is both well arranged and has priority, it is clearly better to re-group the Freeport System in the First Basin in harmony with the old and well known nomenclature.

The Middle Freeport bed therefore becomes the *Lower Freeport* bed; and the Lower Freeport bed of the Clearfield and Somerset reports is really the *Upper Kittanning Coal*, a bed which is only 18 inches thick at Kittanning, on the Allegheny river, but which is a large bed at numerous other places, and is as persistent as any of the beds of the Lower Productive series.

The scheme of the Freeport and Kittanning Groups, as suggested above, is as follows:

Allegheny River.	Terms used in Cambria and Somerset.	Re-grouping of Cambria and Somerset.
E. Up. Freeport C.	E. Up. Freeport C.	E. Up. Freeport C.
Freeport Limestone.	Freeport L.	Up. Freeport L.
D. L. Freeport C.	D′. Mid. Freeport C.	D. L. Freeport C.
	Mid. Freeport L.	L. Freeport L.
Freeport SS.	Freeport SS.	Freeport SS.
Coal.	D. L. Freeport C.	C′. Up. Kittanning C.
	Limestone, ferriferous,	Johnst'n Cement B.
C. Kittanning C.	C. Kittanning C.	C. L. Kittanning C.
Ferriferous Limestone.		

It will be seen that by the above re-grouping no changes are made in the Allegheny river section, but only certain additions. The Johnstown Cement bed, underlying the coal bed which in the re-grouping is termed the Upper Kittanning* (and which was never named at all by the First Survey, but has been the fruitful parent of many errors by being mistaken for the Kittanning bed beneath it) is the most striking feature of the southern part of the First Basin.

It has been named from the place of its greatest development in the Basin, Johnstown, but it is opened at hundreds of other places in the first and second sub-basins, and is the key to the geological horizons all through Somerset and Southern Cambria.

This explanation will suffice to show what these Reports would at present indicate as the most simple and consistent future grouping of the Freeport coals.

The Report of 1874 was already published and the Report of 1875 prepared for the press before this re-grouping was worked out; and it was therefore deemed better to continue the triple group through the Report of 1876 to finish the First Basin on a consistent scheme. But with this Report on Somerset county the triple Freeport group will cease to be used, and the more accurate re-grouping will take its place.

The Johnstown Cement Bed.

The geological horizon of the Johnstown Cement bed is from 100 to 110 feet below bed E, or the Upper Freeport coal. And it holds this interval with wonderful regularity, rarely varying so much as 10 feet from the average.

In the very complete section of the Snow Shoe Basin in Centre county the Cement bed is entirely wanting.

The complete detailed vertical sections of the Lower Productive Measures in Clearfield county are not very numerous; but none of them show the Johnstown Cement bed.

It is not found in any of the sections made in the First Basin until the Conemaugh river is reached. From the Cone-

*Mr. J. C. White identifies this bed under the name of the *Darlington Coal*. He finds it to be in Beaver and Butler counties a variable but persistent bed. In Butler county it has a limestone underlying it which he calls the *Butler Limestone*. This is the *Johnstown Cement bed*.

maugh south to the Maryland line it is as regularly present as it was regularly wanting from the Conemaugh north to the Susquehanna.

In character the bed through Somerset county is equally persistent. It is almost always more or less of a cement bed, and is so ferriferous that only with difficulty can it be used to make an impure lime, scarcely available for agricultural purposes.

In size the cement bed shows the usual variations which are common to all limestone beds. It is sometimes 10 feet thick in three layers of varying quality (in one case dolomitic); and in other places it is only 1 to 2 feet thick; the average being probably about 5 feet.

The facts about the bed are these:

1. It is persistent in the southern part of Cambria and through the whole of Somerset county.

2. It lies 100 to 110 feet below coal bed E, and has a coal bed lying directly on top of it.

3. It is a cement bed, and ferriferous.

These facts relate only to the First Basin.

In Beaver and Butler counties, Mr. White finds (Report on Beaver county not yet published) a limestone under his Darlington coal bed, a name given by him to the Upper Kittaning coal bed.

In Indiana county, Mr. W. G. Platt finds (Report not yet published) the Johnstown cement bed about 100 feet below coal bed E, and having the same general characteristics as in the First Basin.

"*Ferriferous Limestone*" *of the Allegheny River.*

The geological horizon of the Ferriferous Limestone on the Allegheny river was very clearly defined by the First Survey. It was the most important deposit of the region, numerous small furnaces drawing their entire supply of iron ore from the ore deposited on top of it.

Three salient points in the section along the Allegheny river, given in the Old Report of 1858, strike us:

1. The Mahoning Sandstone.

2. The Upper Freeport Coal and Limestone.

3. The Ferriferous Limestone and ore, 220 to 235 feet below the U. F. C.

Wherever the sections are complete and no errors or misidentifications have been made by the observer, these three features are regular and strongly marked.

An accurate detailed vertical section of the Lower Productive Measures on the Allegheny river is reproduced below. It was made at Brady's Bend, in Armstrong county.*

Coal	1′ 0″	Upper Freeport coal, bed E..	9′ 3″
Fire-clay and roof slate..	1 to 1 6		
Coal, mined	2 4		
Slate	0 3		
Coal, mined	1 10		
Slate	6″ to 2 0		
Coal	0 4		
Fire clay and shale (with ball ore 2″ thick)	7′ to 8 0		
Limestone, Freeport	5 0		
Fire clay (with ore balls)	7 0		
Fire clay (without ore balls)	6 0		
Freeport iron ore	2′ to 4 0		
Fire clay (sometimes with ball ore)	1′ 8″ to 2 0		
Thin bedded sandstones	30 0		
Coal, Lower Freeport	1′ 6″ to 4 0		
Shale, passing down into Freeport sandstone, thin bedded	65 0		
Coal, not seen, but reported	0 10		
Interval	45 0		
Coal, Upper Kittanning	1′ 0″ to 4 0		
Shales, olive and blue	30′ to 40 0		
Coal, Lower Kittanning	3 6		
Sandy shales	18 0		
Silicious slab ore, Buhrstone ore	3″ to 2 0		
Sandstone and sandy shale	12 0		
Ferriferous Limestone	15 0		
Blue shales and sandy shales	30 0		
B. *Coal*, Clarion	2′ to 3 0		
Sandstone	20′ to 30 0		
A. Coal, Brookville.			
Shale	25 0		
Coal, Tionesta	1′ to 1 6		
Tionesta sandstone	60 0		
Bituminous shale (with SS.)	20 0		
Seral Conglomerate (XII) in river bed.			

The interval between the Upper Freeport coal and the Ferriferous limestone as given above is 256 feet.

*From a report on the Brady's Bend Coal and Iron Company's land, made by Prof. J. P. Lesley, 1865.

A very unusual feature is presented in this section of a coal bed 65 feet below the Lower Freeport coal, and yet 45 feet above the Upper Kittanning Coal. This coal *was not seen* by Prof. Lesley, and there is no coal in the regular general system which would correspond to it.

Inasmuch as the bed is reported as "becoming a cannel-like coal," and as the Upper Kittanning coal (or bed C′ of the reconstructed Allegheny Mountain system) runs into a cannel coal on this same property, and, moreover, shows a tendency to do so in that region, there may be only one coal bed, instead of the two.

This would reduce the interval between the Upper Freeport coal and the Ferriferous Limestone to about 225 feet, in the above section, which is the general average distance of the two beds apart along the Allegheny river.

To the south-westward of the Allegheny river, through Butler and Beaver counties, the Ferriferous Limestone is a constant horizon, and keeps the same or perhaps a somewhat greater interval between itself and coal bed E.

Its character is very variable, as well as its size, ranging from 15 feet thick down to almost nothing, and from a very ferriferous stone to a very pure ore.

Throughout all the Clarion and Red Bank country the Ferriferous Limestone is a valuable deposit of limestone and iron ore; and it underlies the *Upper* Freeport coal by fully 230 feet.

On Red Bank creek the Ferriferous Limestone, 5 feet thick and with 1 foot of iron ore on top, is 148 feet below the *Lower* Freeport coal, erroneously called in the section given on page 229, Report of Progress, H., (1874,) the Upper Freeport.

In a vertical section made on the Conemaugh river, in Armstrong county, in the First Basin, the Ferriferous Limestone and ore show themselves 230 feet below coal bed E.

The facts concerning the Ferriferous Limestone of the Allegheny river are then these—

1. It underlies the Upper Freeport coal bed E by at least 230 feet on the average.

2. It varies much in character, but is never a cement bed, and nearly always carries iron ore on top.

3. It is very regular and persistent in its horizon, and shows no more tendency to change than any other limestone bed.

Non-identity of the two ferriferous limestone deposits.

From the facts given above, it is clear that the interval of 230 feet between the Ferriferous Limestone of the Allegheny river and coal bed E, an interval which is carried without any change or sign of growing diminution as far east as the Fourth basin, would have to thin down to 100 feet, in order to allow of its identification with the Johnstown Cement bed of the First Basin (which is also found at the same horizon in Indiana county in the Second Basin).

Such a change in such an interval is of course entirely possible, but would require very positive and clear proof in face of its inherent improbability.

The junction point, the only place in which there are as yet no complete sections, is Indiana county, west of Chestnut Ridge, and the report on that county for 1877 will probably settle this question.

In the meantime the strong likelihood furnished by the facts above stated that the two limestones are totally distinct and separate deposits is much strengthened by some few facts exhibited by the sections of the First Basin.

1. In the Snow Shoe Basin,* in Centre county, the vertical section of the Lower Productive Measures shows a 4 foot bed of carbonate iron ore, 232 feet below the Upper Freeport coal. This, it will be noted is exactly the horizon of the Allegheny river Ferriferous Limestone *as to distance.*

2. In the Hooversville section, in Somerset county, (page 122 of this volume,) a bed of carbonate iron ore, two feet thick, is seen 230 feet below coal bed E, or the Upper Freeport coal.

3. In a section made at Faidley's, on Laurel Hill creek, in the south-western portion of Somerset county, (page 246 of this volume) there occurs a limestone bed, overlaid by a curious carbonate iron ore conglomerate, the horizon of which is a little more than 100 feet below the Johnstown cement bed (which is opened on the same hill) and is therefore about 220 feet below the Upper Freeport coal bed E.

*Report H, 1874, p. 69.

These are the only cases in the First Basin, as recorded in the sections embraced in the Reports of Progress, where beds of carbonate of lime and iron come into the measures at the horizon of 230 feet below coal bed E, or between coal beds A and B of the Allegheny Mountain.

These three cases falling on the exact horizon of the Ferriferous Limestone of the Allegheny river make it almost impossible to believe the occurrence of the ore at this horizon a mere coincidence, having no connection with the Ferriferous Limestone of the Allegheny river.

It must not be imagined, however, that the two sections of the Allegheny Mountain and Allegheny river are yet satisfactorily reconciled, for it will be observed on the face of the section that the Ferriferous Limestone on the Allegheny river lies *under coal bed C* or the Kittanning coal bed; and the carbonate iron ore exposures just named are clearly between coal beds A and B of the Allegheny Mountain system. Without attempting to locate, therefore, the exact horizon of the Allegheny River Ferriferous Limestone in the First Great Basin, it is sufficient to say that every indication points to the conclusion that the Johnstown cement bed is an entirely different bed from the Ferriferous Limestone of the Clarion, Red Bank and Allegheny river valleys.

The upper part of the section, from the Mahoning sandstone down to the Lower Kittanning coal bed seems to be clearly identifiable from the Allegheny river to the Allegheny Mountain, and to present but little more variation in that distance than it displays in a distance of 50 miles along the Allegheny river.

The First Geological Survey of Pennsylvania on reaching Somerset county, identified the Johnstown Cement bed with the Ferriferous Limestone bed of the Allegheny river. This error tended to cloud the sections and render impossible a plain statement of the measures in Western Pennsylvania.

Once possessed of the key furnished by a knowledge of the limestones, their horizons, their appearances and disappearances, as already given in the volumes of Reports of Progress in the First Basin, the whole system of measures in the basin is found to be simple, regular, and easy of practical application to any given point.

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ERRATA.

On page 55 ..... for Plate XVII read XVIII
On page 84 ..... for Plate VII read VI
On page 112 ..... for Plate XVII read XVIII
On page 204 ..... for Fig. 82 read 81
On page 205 ..... for Fig. 82 read 81
On Page 235, sixth line from bottom. *de*scending instead of *a*scending.

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First Bituminous Coal Basin in Somerset Co. Pennsylvania.

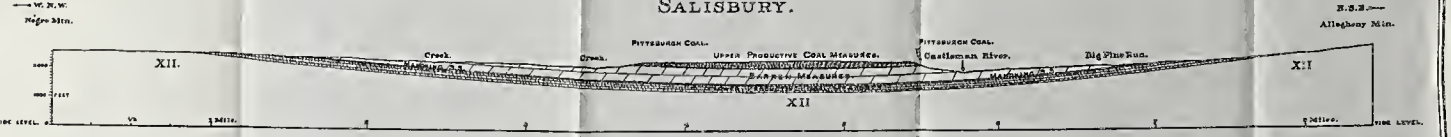
(First Sub-Basin)

Fig. 9.

Berlin.

Fig. 26.

Salisbury.



SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA
REPORT OF PROGRESS 1874 & 1876.

A MAP
of
SOMERSET COUNTY
From Township Maps.

Scale of Miles

A. Addison Twp.
AL. Allegheny.
B. Brothers Valley.
C. Commonwealth.
EL. Elk Lick.
E. Brothersvalley.
J. Jenner.
JE. Jefferson.
L. Larimer.
LT. Lower Turkeyfoot.
M. Milford.
MC. Middle Creek.
N. Northampton.
P. Paint.
Q. Quemahoning.
S. Somerset.
SC. Stonycreek.
SH. Shanks.
SQ. Southampton.
SU. Summit.
UT. Upper Turkeyfoot.

LIST OF SECTIONS & MINES

REFERRING TO NOS. ON THE MAP.

Berlin — Salisbury Sub-Basin.

1 J. Kuntz Mine ..... S. N.
2 Section at Kuntz Farm ..... "
3 M. Swygert Mine ..... "
4 Hetherington Mine ..... S. C.
5 Section at Hetherington's ..... "
6 S. Grove Mine ..... "
7 Stadtler Mine ..... S. N.
8 Section at Silver Diggings ..... "
9 Cross Section Berlin basin ..... "
10 Section Berlin Measures (compiled) S.
11 Section at Kimmel Hill ..... "
12 " " Philson " ..... "
13 " " H. & S. Coleman ..... "
14 " " Pine Hill ..... "
15 " " W. Walker Hill ..... "
16 " J. Walker (Berkley's Mills) S.
17 S. Coleman Mine ..... S.
18 Price Mine ..... "
19 Hay Mine ..... "
20 Gable Mill ..... "
21 Feltz Mine ..... "
22 W. Walker Mine ..... "
23 W. Walker coal & limestone ... "
24 P. Hay Mine ..... S. U.
25 Wigle Mine ..... S.
26 Cross Section Salisbury basin ... E.
27 Salisbury Section (compiled) ... "
28 Aaron Cumberland Section ..... "
29 Section on Elk Lick Creek ... S. U.
30 " at Keystone Mines ... "
31 " " Wilhelm Mines ... E.
32 " " Keim & Shivengood's ... "
33 " M. J. Beachy's ... "
34 Saylor Mine ..... S. U.
35 Cumberland & Elk Lick Mine ... "
36 Keystone Mine ..... "
37 Wilhelm " Pittsburgh Coal ... E.
38 Wilhelm " Elk Lick Coal ... "
39 M. J. Beachy Mine ..... "

Somerset Sub-Basin.

40 Eash Mine ..... C.
41 G. W. Clark ..... S. H.
42 Section at Baversville ... Q.
43 Stonerstown Mine ..... "
44 W. Will ..... "
45 Section at Stoystown ..... "
46 J. A. Barnhardt Mine ..... "
47 Ramon Mine ..... S. C.
48 Section at Paint Creek ... P.
49 J. Weaver Mine ..... "
50 G. Schafer ..... "
51 J. Ripple ..... "
52 A. Schafer ..... "
53 Justus Oyster ..... "
54 Section at Eyster's Mill ... "
55 P. Berkey Mine ..... "
56 Jacob Custer Mine ..... "
57 J. Kimbel ..... "
58 L. Rudger ..... S. H.
59 Shale Furnace ..... "
60 H. Petterd ..... "
61 Section at Cherry Hill ... J.
62 H. Weaver Mine ..... J.
63 Margaret's Mill Mine ..... "
64 Zimmerman ..... S.
65 S. Baer ..... "
66 L. Schafer ..... "
67 D. Kimmel ..... "
68 Heltzer ..... "
69 L. Bugna ..... "
70 Ankeny ..... M.
71 Sether ..... "
72 J. Myers ..... "
73 Compiled Castleman Section ... "
74 Hetherington's Mine ..... "
75 Section at Mineral Point ... "
76 " " Castleman Village ... "
77 Bed Ant Castleman ..... "
78 Zufall Mine ..... U. T.
79 Reinbach Mine ..... "
80 Section at Pinkerton Point ... "
81 Shoo Fly Tunnel sketch ... "
582 Denudation sketches on 583 Ringle Hill ... "
Johnstown - Confluence Sub-Basin.
82 Section at Yoder Farm ... C.
83 J. T. Yoder Mine ..... "
84 Thomas ..... "
85 P. Berkey ..... J.
86 Section at Forwardstown ... "
87 W. G. Griffith Mine ..... "
88 Sno. Beam ..... "
89 Schell Mill ..... J. E.
90 Henry Mull ..... "
91 P. Putman ..... M. C.
92 Josiah Barron ..... "
93 Section on Laurel Hill Cr. ... "
94 A. Fuidley Mine ..... U. T.
95 Krieger Mine ..... "
96 Rose ..... "
97 Railroad cut ..... U. T.
98 Section at Ursina ..... "
99 Leslie Mine ..... A.
100 Section opposite Fort Hill ... U. T.
101 Section at Harmonville ... A.
102 McClintock Mine ..... "
103 Liston Bros. ..... "
104 Listonville iron ore ..... "
105 Bird Mine ..... "
106 J. Rush ..... U. T.
107 Section at Confluence ..... "
108 Mrs Lenhart Mine, Fayette Co. "

O. D. Rieden, Del.

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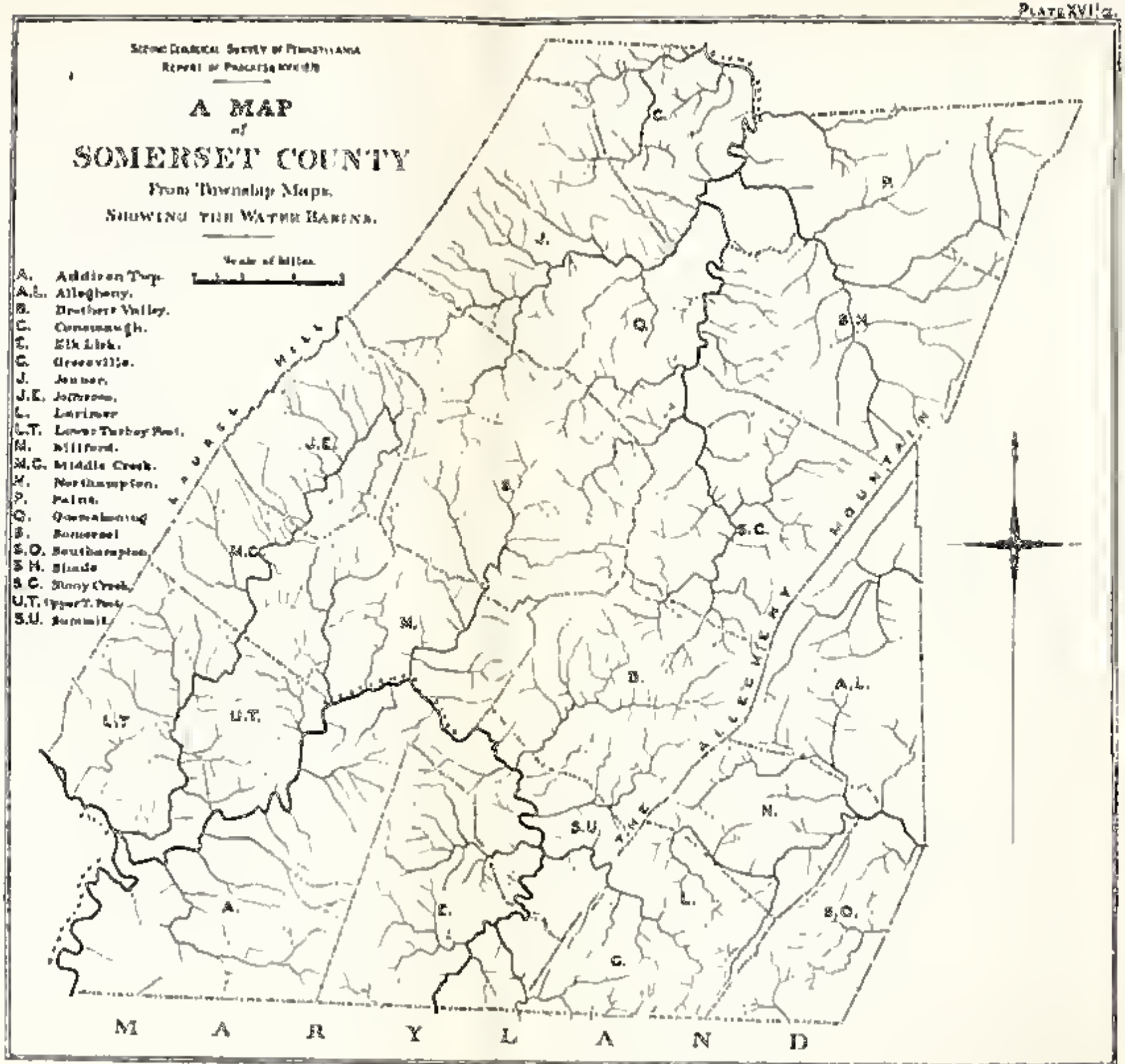
Second Geological Survey of Pennsylvania
Report of Progress xxxviii

A MAP
of
SOMERSET COUNTY
From Township Maps.
Showing the Water Basins.

Scale of Miles.

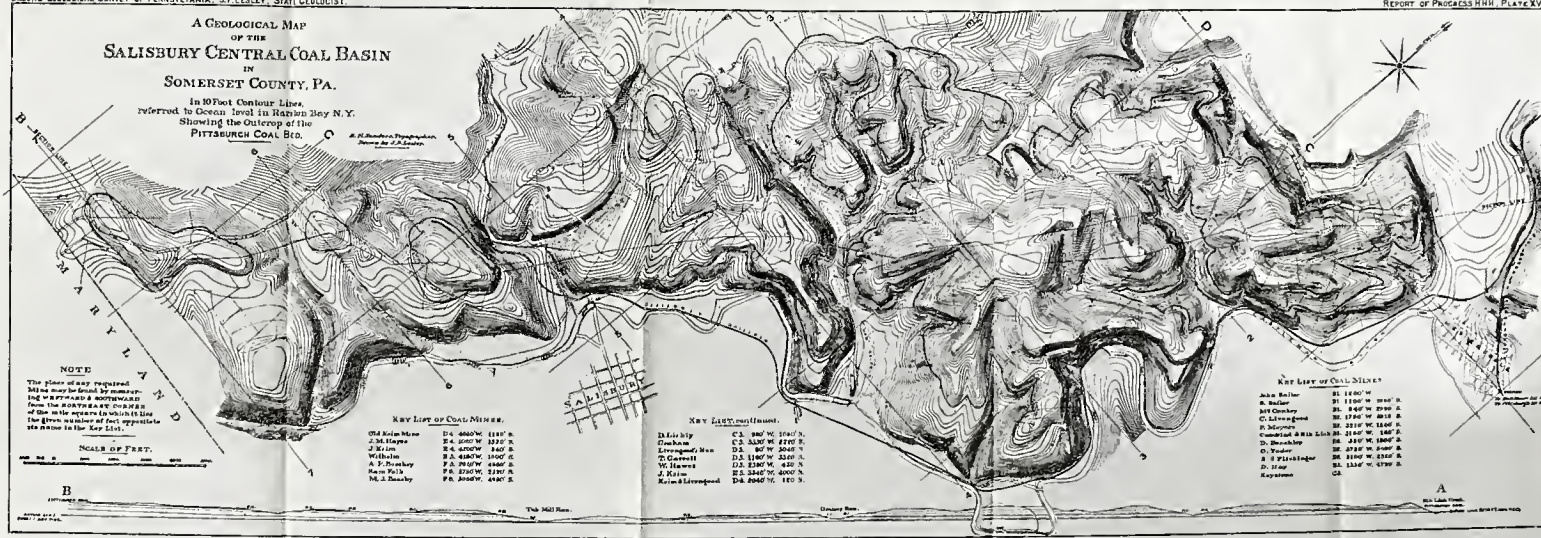
A. Addison Twp.
A.L. Allegheny.
B. Brothers Valley.
C. Conemaugh.
E. Elk Lick.
G. Greenville.
J. Jenner.
J.E. Jefferson.
L. Larimer
L.T. Lower Turkey Foot.
M. Milford.
M.C. Middle Creek.
N. Northampton.
P. Paint.
Q. Quemahoning
S. Somerset
S.O. Southampton.
S.H. Shade
S.C. Stony Creek.
U.T. Upper T. Foot
S.U. Summit



A GEOLOGICAL MAP OF THE SALISBURY CENTRAL COAL BASIN IN SOMERSET COUNTY, PA.

In 10 Foot Contour Lines.
Referred to Ocean level in Raritan Bay N.Y.
Showing the Outcrop of the
PITTSBURGH COAL BED.

E. H. Bandow Topographer.
Drawn by C.A. Ashley.



NOTE

The place of any required Mine may be found by numbering WESTWARD & SOUTHWARD from the NORTH EAST CORNER of the mile square in which it lies The given number of feet opposite its name in the Key List.

SCALE OF FEET.

KEY LIST OF COAL MINES.

Old Keim Mine	D 4	4660 W. 1180 S.
J.M. Hayes	E 4.	1080 W. 1320 S.
J. Keim	E 4.	4700 W. 840 S.
Wilhelm	E 3.	4180 W. 1800 S.
A. F. Pershey	F 3.	780 W. 1680 S.
Ream Folk	F 3.	1780 W. 2180 S.
M. J. Beachy	F 3.	3060 W. 4480 S.

KEY LIST, continued.

D. Lichty	C 3.	980 W. 1060 S.
Graham	C 3.	3330 W. 1700 S.
Livengood's Run	D 3.	80 W. 3040 S.
T. Carroll	D 3.	1140 W. 3260 S.
W. Hawes	D 3.	2280 W. 420 S.
J. Keim	E 3.	3540 W. 4000 S.
Keim & Livengood	D 4.	3060 W. 160 S.

KEY LIST OF COAL MINES

John Keller	B 1.	1140 W.
S. Keller	B 1.	1140 W. 3000 S.
Jos Conley	B 1.	840 W. 2700 S.
C. Livengood	B 2.	1740 W. 3810 S.
P. Meyers	B 2.	2310 W. 1140 S.
Cumbrd & Blk Lick	B 2.	2160 W. 1860 S.
D. Beachley	B 4.	450 W. 1800 S.
D. Yoder	B 4.	2730 W. 3600 S.
S. & Fleishaker	B 5.	2100 W. 4260 S.
D. Hay	B 5.	1320 W. 4740 S.
Keystones	C 5.	

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A GEOLOGICAL MAP OF THE SALISBURY CENTRAL COAL BASIN IN SOMERSET COUNTY, PA.

Showing

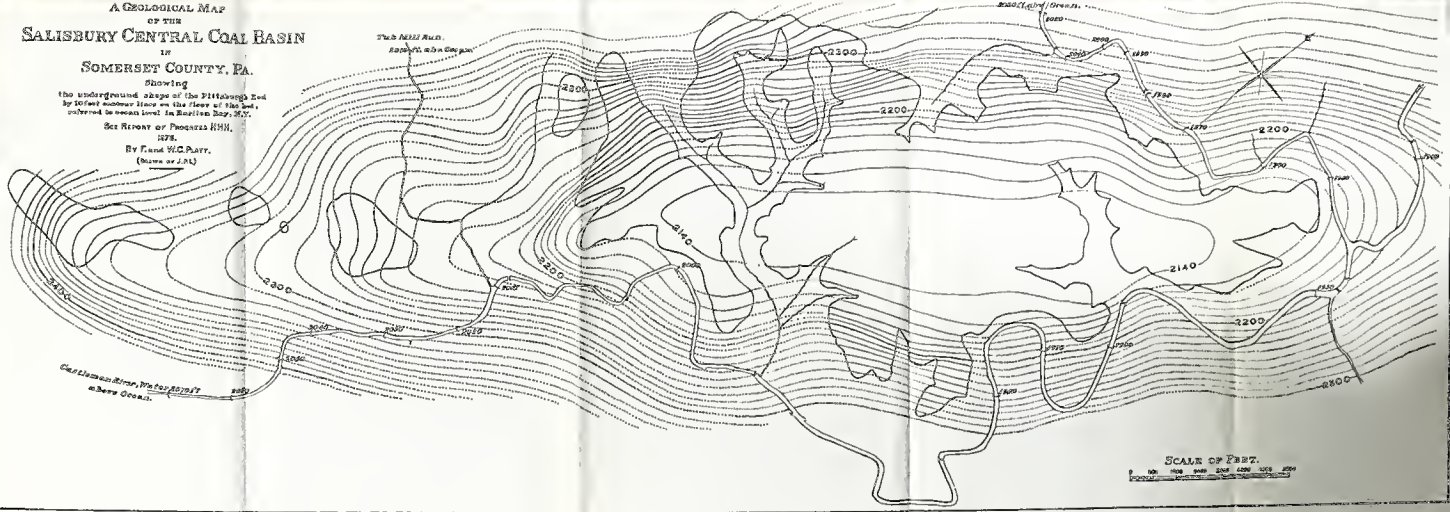
the underground shape of the Pittsburgh Bed by lines of contour lines on the floor of the bed, referred to ocean level in Raritan Bay, N.Y.

See Report of Progress RRR.

1878.

By F. and W.G. Platt.

(Blank or 1.81)



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